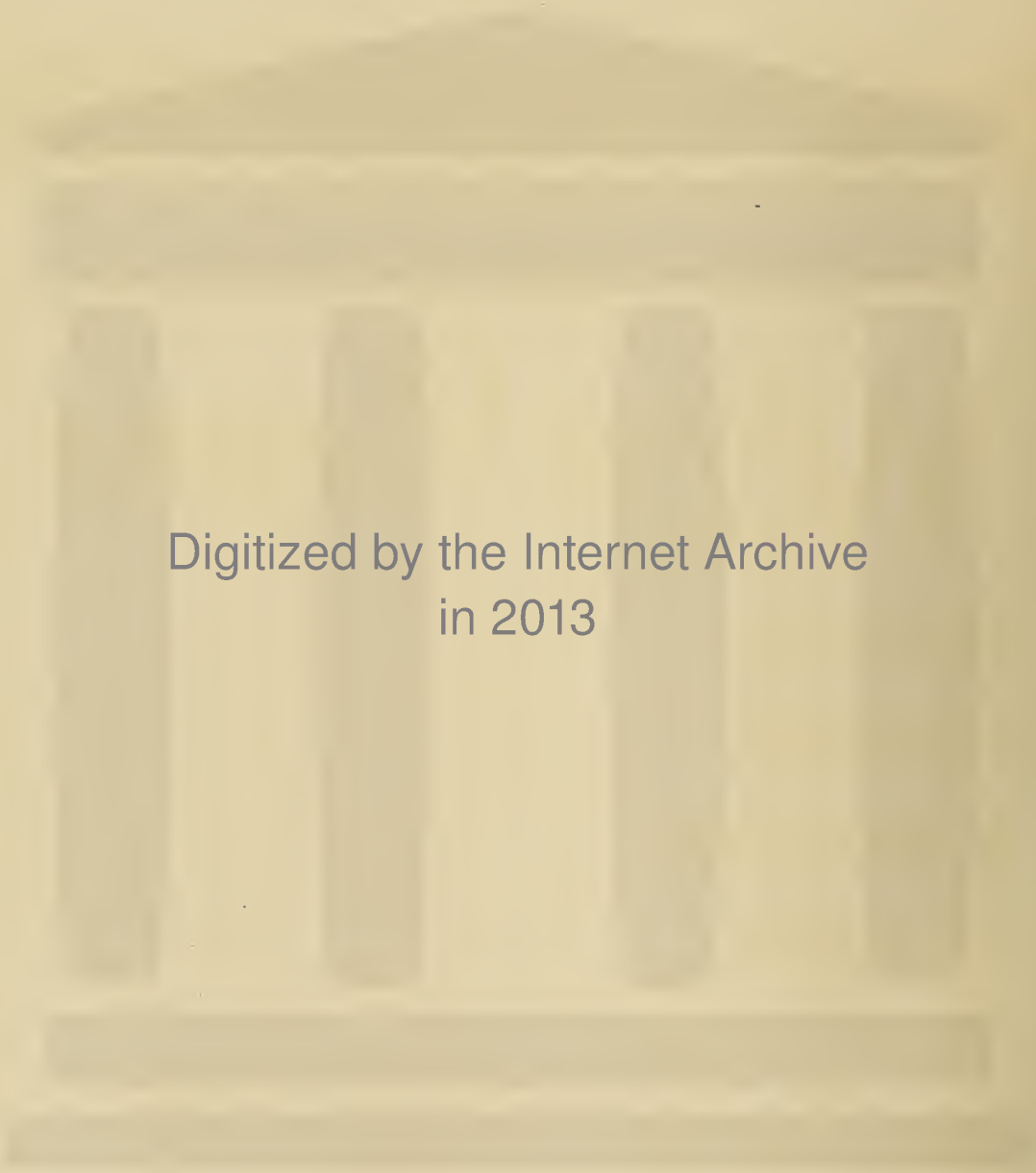


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ADVERTISING INDEX—PAGE 177. BUYERS' DIRECTORY—PAGE 155. EDITORIAL INDEX—PAGE 340

CANADIAN MACHINERY AND MANUFACTURING NEWS

Vol. XXIV., No. 15 Published by the MacLean Publishing Company, Limited, Toronto October 7, 1920 $4.00 a Year Subscription Price

READ AND PASS TO	check	See Page	READ AND PASS TO	check	See Page	READ AND PASS TO	check	See Page
						RETURN TO	For	File

Wire Ropes for

Hoisting
Haulage
Cableways
Dredges
Steamshovels
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The B. Greening Wire Co., Limited

Hamilton, Ont. Montreal, Que.

SMALL TOOLS

Pratt & Whitney Adjustable Blade Reamers

These reamers have eccentric relief and can be set to size without regrinding. They are unexcelled for design and simplicity and ease of adjustment.

The eccentrically relieved blades are stronger than others, do not chatter, and produce a smoother hole. The hand, shell and fluted chucking reamers have interchangeable nuts, screws and wrenches. The bottom of a hole can readily be faced.

By a simple adjustment of the blades the reamer can easily be set to size, without regrinding.

Prompt service is assured at our nearest store, where P. & W. Small Tools are carried in stock for immediate delivery. Place your order there to-day.

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OF CANADA, LIMITED

Works: Dundas, Ontario

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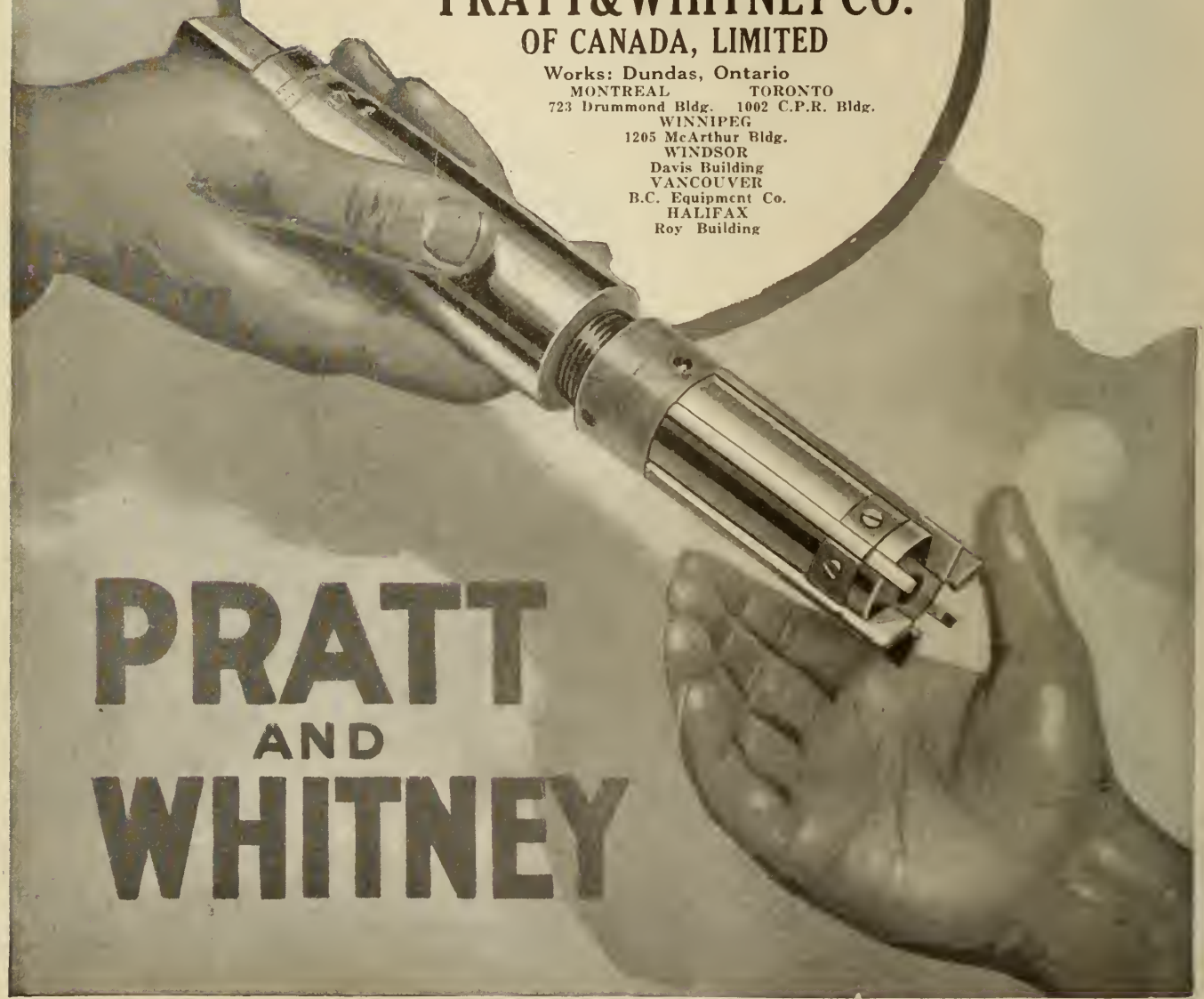
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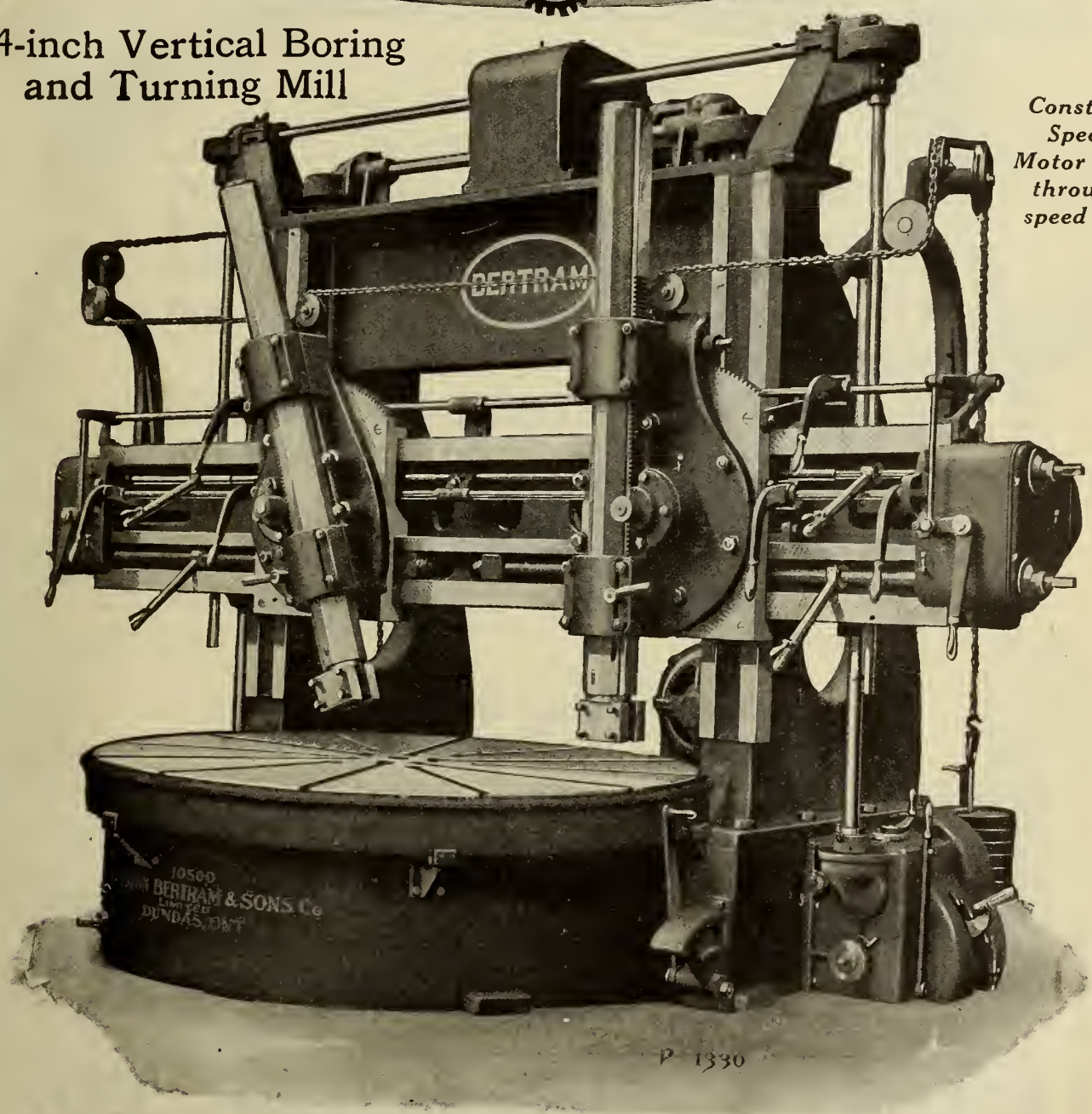
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The BERTRAM Page

MACHINE TOOLS

84-inch Vertical Boring and Turning Mill

Constant Speed Motor drive through speed box



The John Bertram & Sons Co., Limited

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Canadian Machinery and Manufacturing News, October 7th, 1920. Vol. 24, No. 15. Published weekly at 143-153 University Avenue, Toronto, Canada. Subscription price in Canada, $4; United States, $4.50. Entered as second-class matter at the Post Office Department, Ottawa, Canada. Entered as second-class matter July 1, 1912, at the Post Office Department at Buffalo, under the Act of March 3rd, 1879.

If It's for the Shop

STRELINGER'S

Have It !

The steady growth of our Canadian business, during the short time we have operated our Windsor store, indicates plainly that STRELINGER Service appeals to the Canadian trade.

He who buys from STRELINGER'S is satisfied, because he gets good quality, a low price, service that is the best we can make it, and a square deal.

Our stock is large and varied, and consists of—

Metalworking Machinery
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Tools and Shop Supplies
of All Kinds

Let Us Figure on Your Requirements

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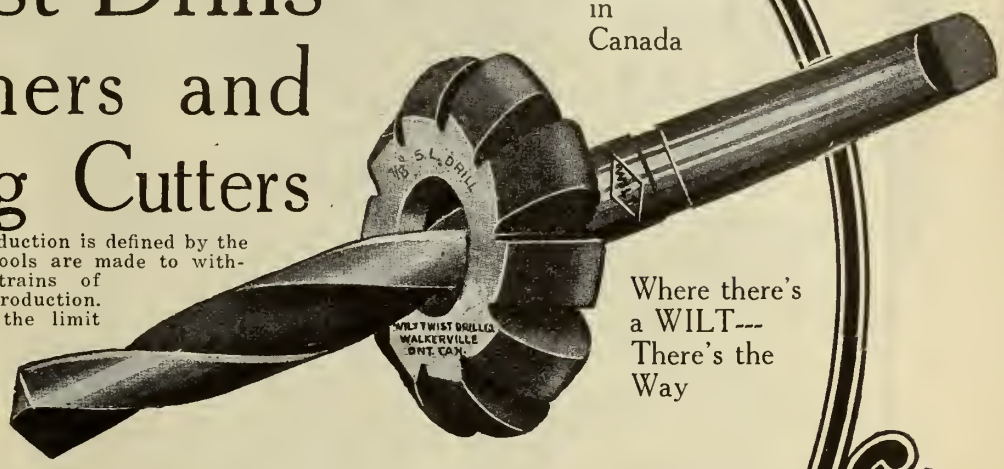
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Twist Drills Reamers and Milling Cutters

Made in Canada

In these days your production is defined by the tools you use. Wilt tools are made to withstand the terrific strains of modern demands of production. They can be pushed the limit and stand more abuse than any other tools. Tools that insure faster and better feed with greater production and less regrinding.



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Ask your dealer or write direct for Catalog "C"

TRADE WILT MARK

Wilt Twist Drill Co.
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All of these steels are supplied in

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We also furnish in BLOOM, BILLET AND SLAB FORM

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For the better convenience of customers who may find it necessary to secure rush shipments of particular items, we are keeping a large stock of all the various standard sections constantly on hand, and to this end extensive warehouse facilities are being prepared. Your enquiries and business will be appreciated.

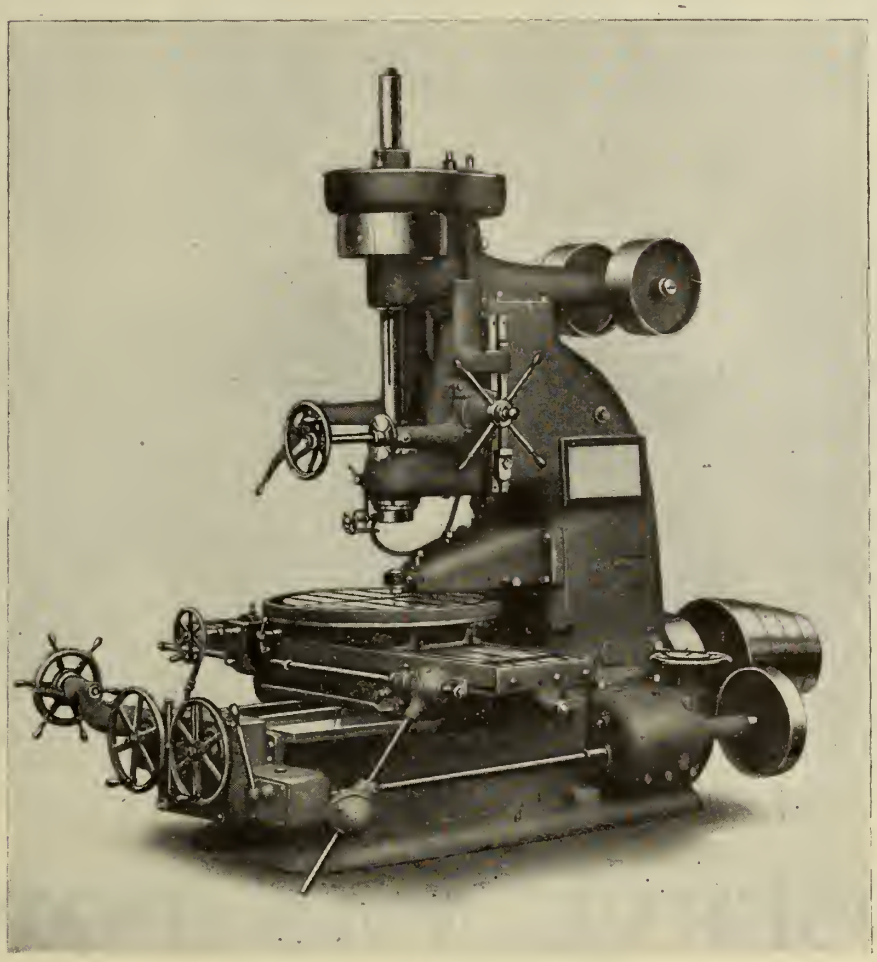
May we have your next order?

Algoma Steel Corporation, Limited

SAULT STE. MARIE, ONTARIO, CANADA

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DELIVERY



NO. 8 VERTICAL MILLING MACHINE

WITH PROFILING ATTACHMENT AND CIRCULAR TABLE

62" x 38" x 28½"

Our No. 8 Vertical Milling Machine presents a tool of unusual range and adaptability.

It can be arranged for plain milling or provided with profiling attachment as illustrated or with repetition die sinking equipment.

We can offer early deliveries on a number of sizes of our milling machines.

ALFRED HERBERT, LTD.

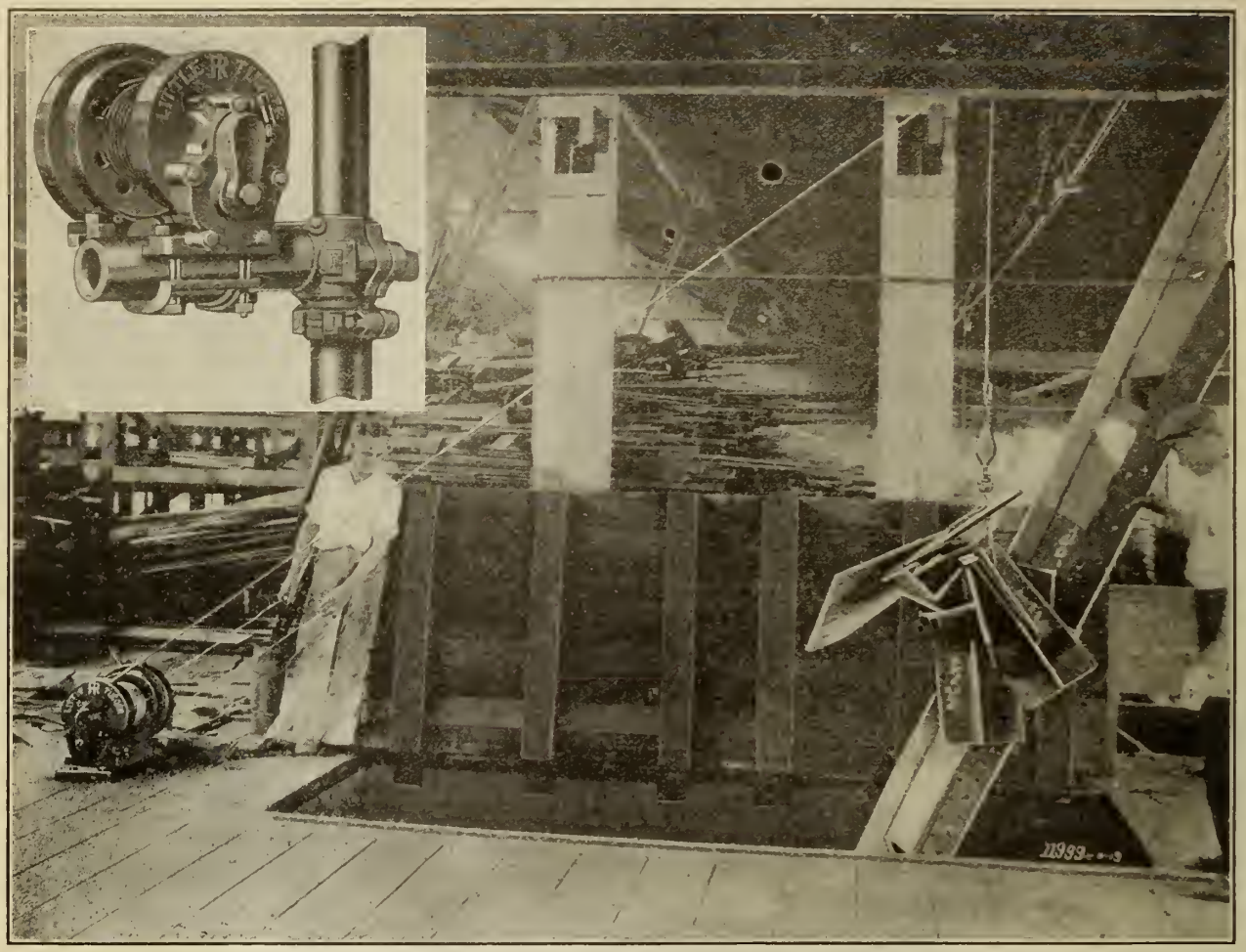
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Turret Lathes, Engine Lathes, Horizontal Boring Machines, Boring Mills, Planing Machines, Slotting Machines, Shaping Machines, Profiling Machines, Grinding Machines, Sawing Machines, Precision Machines, Chucks, Die Heads, Tool Room Equipment, Foundry Equipment, Drills, Milling Cutters and Small Tools.

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A "Little Tugger" is used in the Chester Shipyards for hoisting structural steel into a storage loft above the punch shop.

CONSERVE MAN POWER

Spotting small cars, hoisting coal, ashes, sand or ice, Loading boats, cars and trucks, Hauling and skidding timber, or boxes and bales in the warehouse, Hoisting in the foundry where the lift is more than 20 feet, Powerizing hand cranes in the yard or shop, Erecting machinery and handling brick, stone, cement, mortar, lumber or steel, in building construction and repair, are a few of the "Little Tugger" jobs around the average manufacturing plant.

"Little Tuggers" will do this work quickly, surely and economically and permit your men to work without costly stops to "lend-a-hand."

"Little Tuggers" are light in weight, easily carried about; can be quickly and conveniently bolted or clamped to any handy support, and will operate in any position with equal satisfaction.

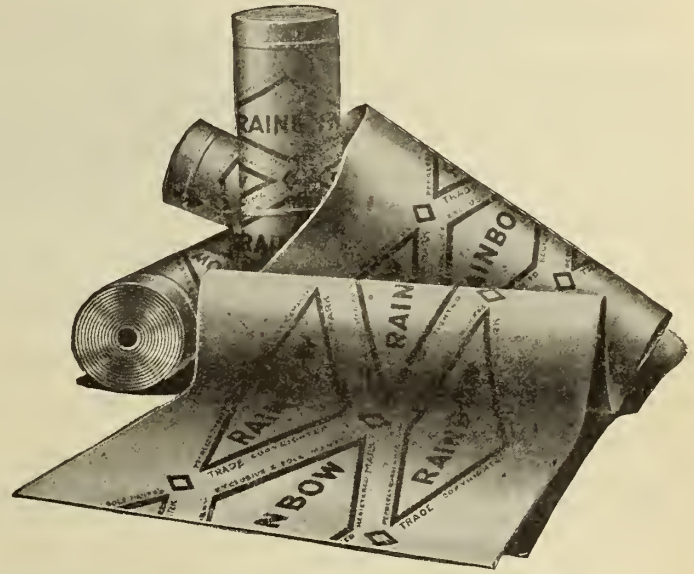
"Little Tuggers" do not need an engineer—anyone can run them. Control and braking are simple, positive and safe. Lubrication is automatic and does away with the need for expert attendance.

"Little Tuggers" are built in two styles—No. IH for wire rope and No. IIH for manila rope. The load limits are respectively 1,000 and 600 pounds; the lift 700 and 300 feet; the speed 85 feet per minute. The hauling capacity of the IH model ranges from 50,000 pounds at zero grade to 1,090 pounds at a 63 deg. angle of inclination and the capacity of the IIH is about 40 per cent. less. Both models are made for compressed air and steam operation. Bulletin 4333, sent on request, describes these hoists in detail.

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30 Years of Unexcelled Service

—under the most exacting conditions—have proved the worth of Rainbow Sheet Packing wherever steam is used. It is the *original red sheet* packing and the "Rainbow" Diamond trade-mark is your assurance of dependability.

Rainbow Sheet Packing

is the one gasket material that may be depended upon to give faithful service and save many replacements.

We will gladly send you a catalogue and, if you wish, one of our technical experts will help you select the right packing for your particular requirements.

Genuine Rainbow Sheet Packing is made in Canada.

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Dominion Rubber System

Rainbow Rubber Products Department

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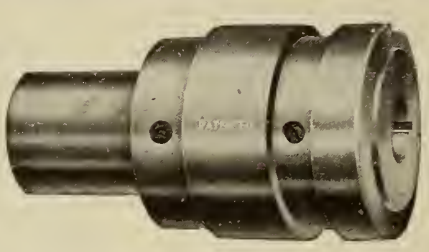
THE JOHNSON FRICTION CLUTCH

IF YOU BUILD MACHINERY

you are anxious to put into your product every refinement which will add to its efficiency—which will make it serve your customer longer and more satisfactorily.

One of the most important features of any machine is its clutches. No single item adds more to machine performance than a good clutch, and nothing can be a greater source of annoyance than a poor one.

Play safe and equip with Johnson Clutches.



Write for Our Yellow Catalog and Booklet "Clutches as Applied to Machine Building"

IF YOU USE MACHINERY

you are looking for the machine with the highest rate of production, the smallest amount of lost time, and the longest life. In all probability you will find that machine equipped with a Johnson Clutch, for the Johnson Clutch not only gives best service, but adds greatly to the convenience and speed of operation.

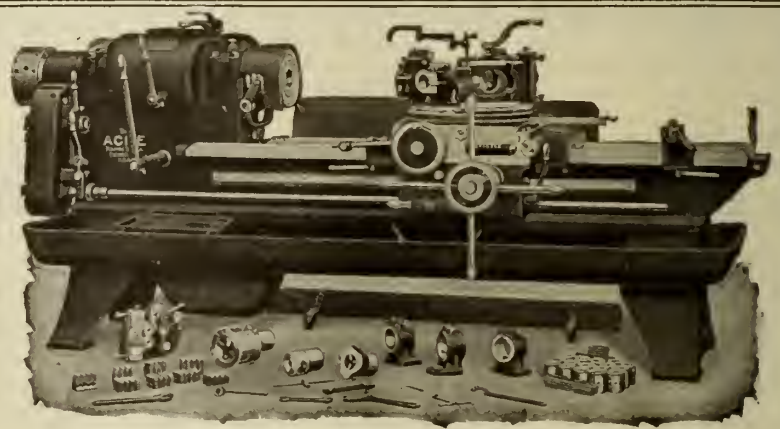
Look for it on the machine you buy, and to be consistent equip your plant transmission in the same way.

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CANADIAN FAIRBANKS-MORSE CO., LIMITED, Montreal, Toronto and Winnipeg

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

Operates on Minimum Power

Only gears running are those doing actual work on this Cincinnati Flat Turret Lathe



3¼ in. x 36 in. Flat Turret Lathe, Equipped for Bar Work

The Cincinnati Acme Flat Turret Lathe puts the full benefit of every bit of power directly into the work; none is wasted in turning disengaged gears.

On either bar or chuck work within its range no better machine than the sliding gear type, double production, geared head Cincinnati Acme Flat Turret Lathe is to be found.

Accuracy, rigidity and constant alignment of spindle with the vees upon which the turret carriage travels, are benefits secured from having the head cast solid with the bed.

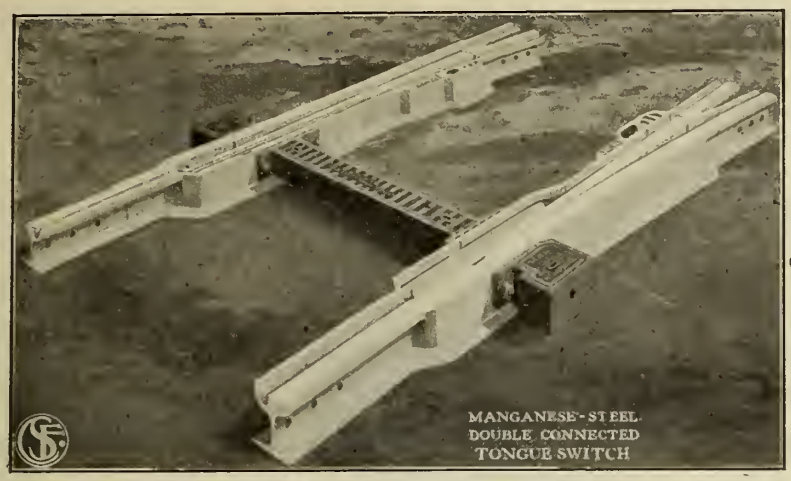
We also make a full line of Screw Machines and Turret Lathes.

A bulletin containing full particulars will be sent upon request.

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Canadian Agents: Rudel-Belnap Machinery Co. of Toronto and Montreal



MANGANESE STEEL TRACKWORK

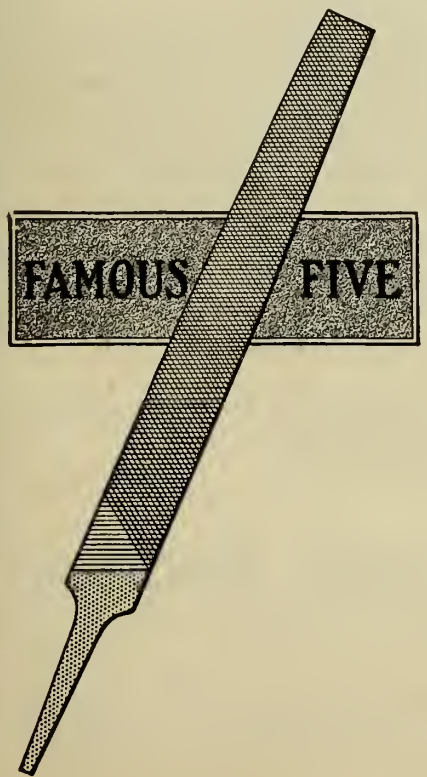
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Steam and Electric Railways

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CANADIAN STEEL FOUNDRIES LIMITED

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Filing a Way Into Public Confidence

For over fifty years we have been literally filing a way into public confidence.

To-day our five trade-marked brands—the "Famous Five"—are firmly established as the standard of file quality.

It would be illuminating to estimate the total amount of wood and metal that has melted away under the steady grind of the Famous Five.

But it has at least been enough to prove that when a file user wants clean-cut results, ease in the handling, and long service, he invariably specifies one of the Famous Five brands:

KEARNEY & FOOT
GREAT WESTERN
AMERICAN
ARCADE
GLOBE

Made in Canada by

Nicholson File Company

Port Hope -- -- -- Ontario

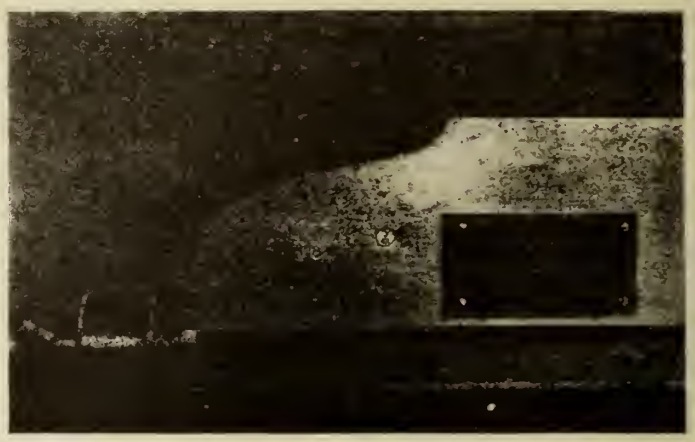
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Ford-Smith

Machine Tools of Quality, Canadian Made

Unobtrusive--- but It Means a Great Deal

This inconspicuous mark on Ford-Smith Milling Machines guarantees that the machine has successfully passed every one of an exacting series of tests.





These tests are severe and cover every detail of construction. Not until the miller has **passed** every test imposed does the inspector place his seal of approval, the mark shown above, on the machine. This is why every miller which leaves the factory gives long, dependable, care-free service.

The cut on the left shows a miller passing one test—for the alignment of the knee.

Any information with regard to Ford-Smith Millers will gladly be furnished.

The Ford-Smith Machine Company, Limited

HAMILTON CANADA

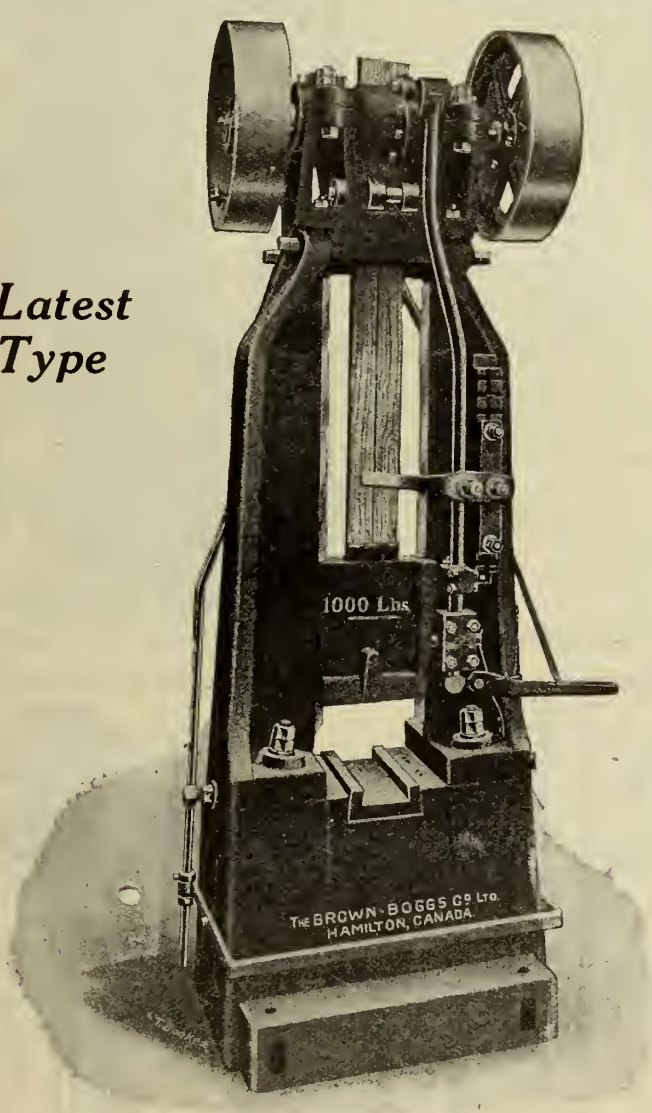
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BROWN-BOGGS

B B

Latest Type



1,000 lb. BOARD LIFT HAMMER

B-B Drop Hammers

THIS 1,000 lb. Board Lift Drop Hammer is representative of our latest type.

The old-fashioned, noisy gears have been eliminated entirely, the hammer being lifted by friction exerted through a powerful eccentric motion under perfect control of the operator at all times.

The hammer has exclusive features that add greatly to its life as well as increasing the quantity of work produced.

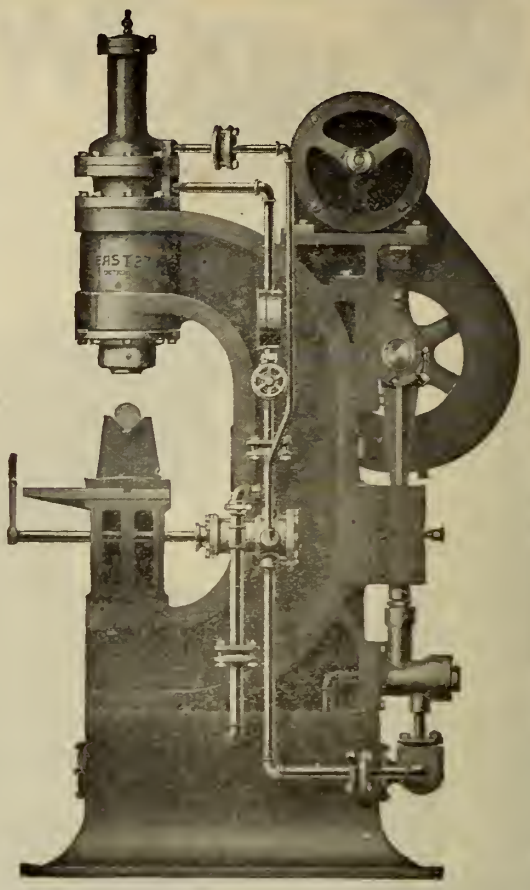
Let us know the type of hammer you are interested in and we will give you full information and advice.

Manufacturers of Sheet Metal Working Machinery, Presses, Shears, Rolls, etc.

THE BROWN-BOGGS CO. LIMITED
HAMILTON, CANADA.

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A SELF-CONTAINED HYDRAULIC UNIT



EASTERN UNIVERSAL HYDRAULIC PRESS. Supplied in 20-35 and 50-ton capacities, full hydraulic depending on no springs or weight for return of ram, delivering pressure instantly at a speed of 1½ in. per second, return of ram 3 in. per second.

Length of Ram Travel.....6 in.
Depth of Throat .....10 in.
Length of Table .....8 ft.
Width of Table .....10 in.
Table to Ram .....10 to 14 in.

EASTERN UNIVERSAL PRESSES are tested before leaving our plant at 33-1/3% overload. They are furnished with rolling centres and are unexcelled for straightening of motor crankshafts, heavy wheel shafts, broaching splines in drive plate, differential gears, and others. Straightening front axles and spindles.

Write for details

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120 Wisconsin St. MILWAUKEE, WIS.

Canadian Representatives:
F. F. BARBER MACHINERY CO., Limited,
Foy Building TORONTO

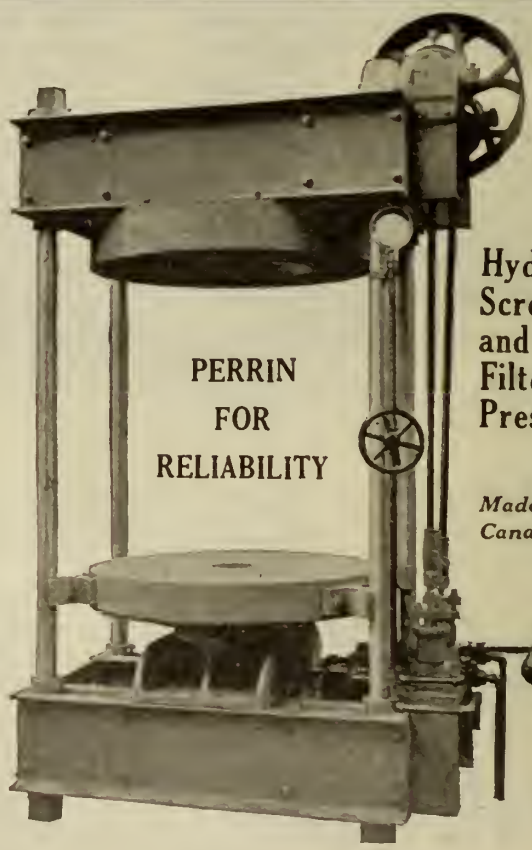
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NAZEL AIR HAMMER



NOTED FOR ITS BLOW AND CONTROL

A self-contained unit, HAMMER AND COMPRESSOR COMBINED, built in three types, six sizes arranged for BELT OR DIRECT MOTOR DRIVE, with capacities up to 7 inches square, for all manner of jobbing, manufacturing and certain classes of drop forgings.

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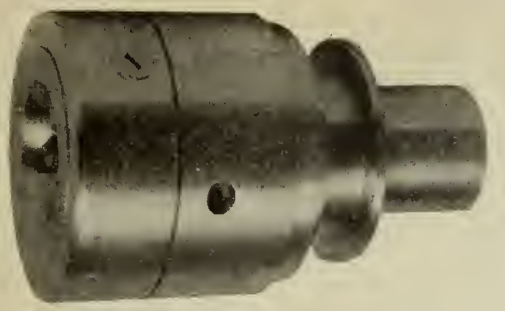
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Hydraulic Screw and Filter Presses

Made in Canada

Hydraulic Truck Tire Press

WILLIAM PERRIN LIMITED - TORONTO



No. 2. TYPE "R"
Hartness Automatic Die

WITH SHANK FOR REVOLVING SPINDLES

These dies are designed for use on either vertical or horizontal spindles. Die is re-locked by forward motion of sleeve, which may be actuated by a yoke working in the groove or by a fixed stop making contact with rear edge of sleeve at the return stroke. Die is unlocked in the usual manner by retarding its forward motion or by a fixed stop, making contact with the external tripping button shown on the face of the die. External tripping button is especially desirable in cutting very short threads as it relieves the thread of the strain incidental to unlocking by the pull-off device.

The diameter of the No. 2, Type R die is 3 3-16 in., and its length as shown is 3½ in.

The Die cuts both right and left-hand threads ½ in. to 1 in. in diameter, and from 10 to 40 threads per inch.

Shanks are varied to meet individual requirements.

A set of standard chasers in carbon steel is supplied gratis with each Die.

No tools of any kind need be used in changing chasers.

A chaser grinding jig is supplied gratis on Die orders if desired.

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(DIE DIVISION)

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LOCOMOTIVE AND CAR WHEEL TYRES

HIGH-SPEED AND CARBON TOOL STEEL

MISCELLANEOUS SHOP TOOLS

MADE IN CANADA

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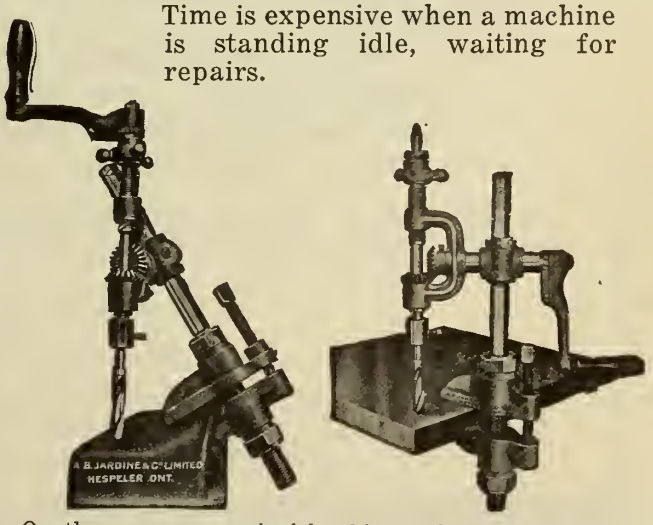
Works:
Longueuil, Que.

BRANCHES:

126 Wellington St. W. TORONTO
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McArthur Building WINNIPEG

Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



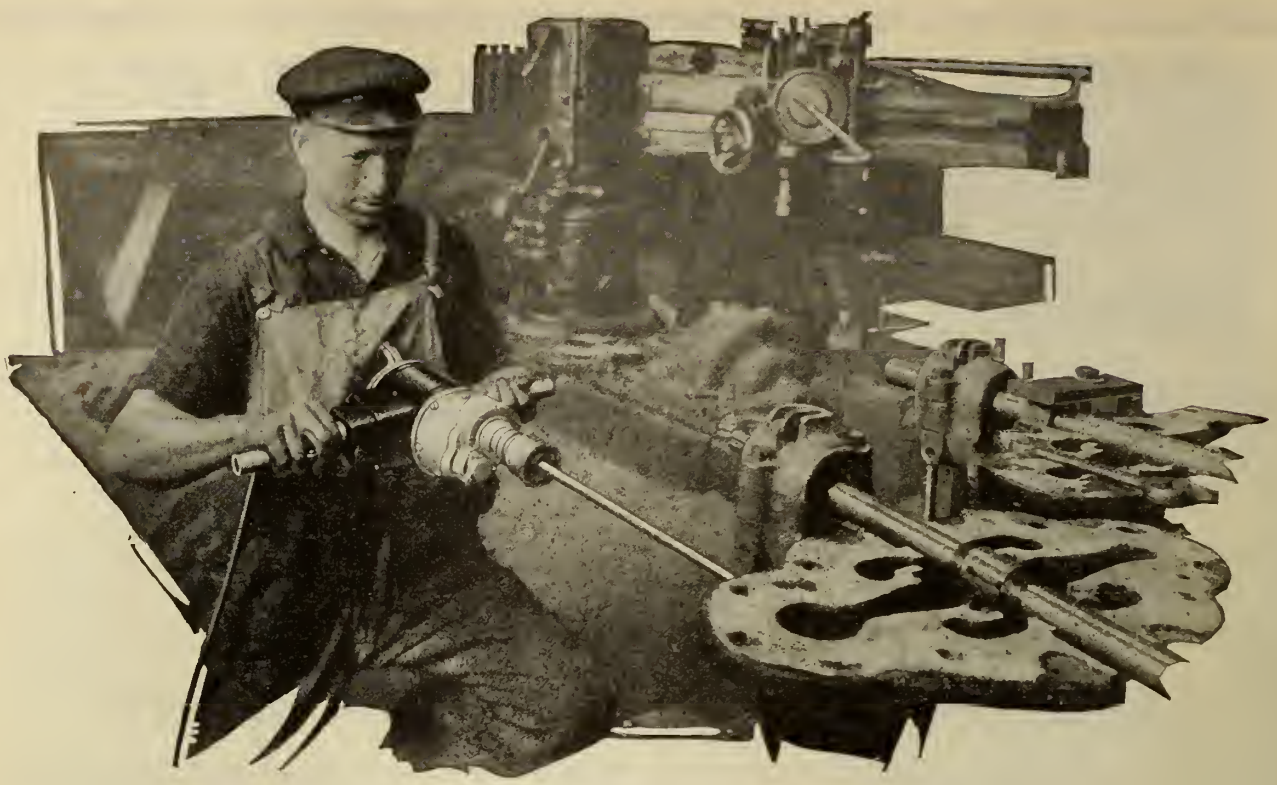
On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.

Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited
HESPELER, ONTARIO

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Not cheaper drills— but cheaper *drilling!*

LOWER-COST-PER-YEAR performance records prove that for length of service and over-all operating economy, Little Giant Portable Electric Drills *stand alone.*

The same design that withstands the severe strains of shipyard and other heavy drilling service, is duplicated in *every* Little Giant, large or small.

Big-calibre engineering design necessary to meet big-user demands for productive efficiency, benefits *alike* the small shop, factory or assembly plant.

Whether you use one or one hundred Little Giants, each drill is backed by *direct personal-touch* service, with stocks of new tools and spare parts at Company Branches. This service "keeps drills drilling."

Little Giant Electric Tools are made for operation on any current and in many sizes and types. Ask for Booklet 397.

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354-356 St. James Street, Montreal, Canada

Sales and Service Branches: TORONTO, 342 Adelaide Street, West WINNIPEG, 150 Princess Street VANCOUVER, 81 Pender Street

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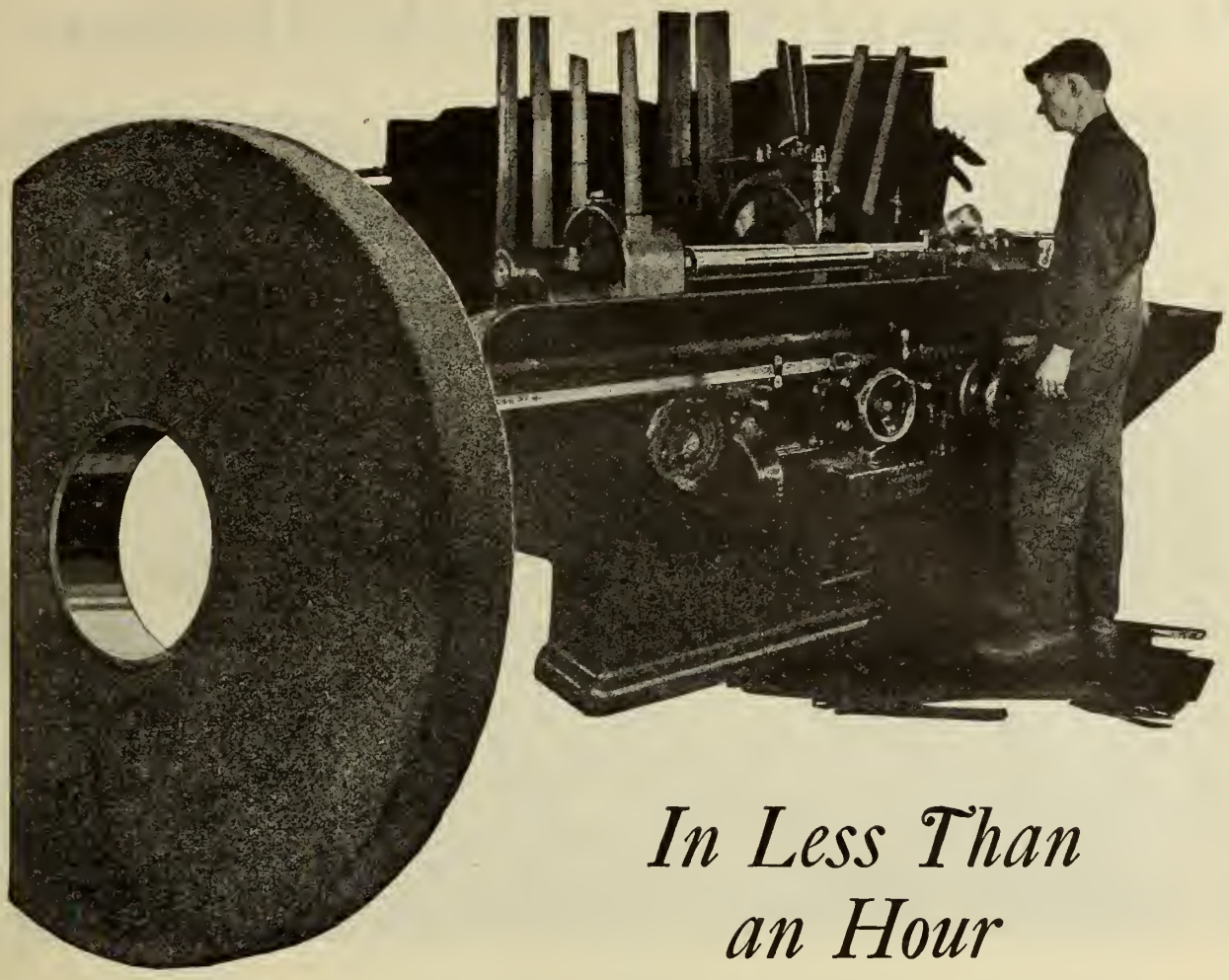
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BOYER PNEUMATIC HAMMERS · LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
CHICAGO PNEUMATIC AIR COMPRESSORS · VACUUM PUMPS · PNEUMATIC HOISTS
GIANT OIL AND GAS ENGINES · ROCK DRILLS · COAL DRILLS

LITTLE GIANT

Electric *Tools*

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.



In Less Than an Hour

IT'S a nice bit of cylindrical grinding that Aloxite Wheels do at The American Tool Works Co., Cincinnati.

The job is grinding six diameter, twenty-inch, 70-point carbon steel lathe spindles. The wheel removes .018-inch stock on the roughing cut, .002-inch on the finish cut, and a very high commercial finish is demanded.

The roughing of the spindles takes twenty-five minutes, the finishing, thirty minutes.

Less than an hour to complete the job!

Just another evidence of exceptional service that Aloxite Wheels are giving to industry.

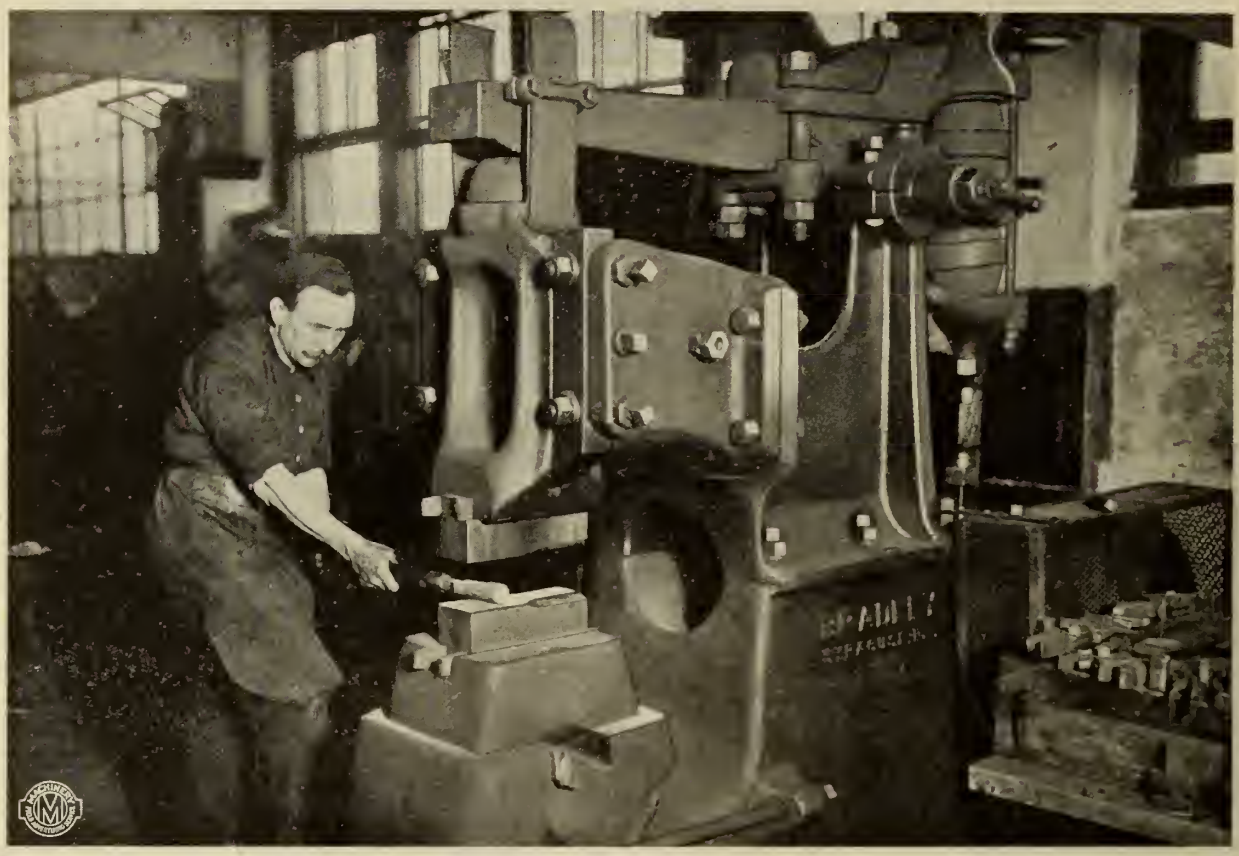
You may or may not be grinding lathe spindles, but whatever your grinding job is, there is the right wheel for it. Carborundum Service sees that you get *that* wheel.

The Carborundum Company, Niagara Falls, N. Y.

New York Chicago Boston Philadelphia Pittsburgh Cleveland
Cincinnati Grand Rapids Detroit Milwaukee

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"Forge Ahead With a Bradley Hammer"



Ten Years With the Brown-Lipe-Chapin Co.

Nearly 3,000 men are employed in manufacturing gears, automobile transmissions, etc., in this big factory. The blacksmith shop is a busy place—and here a veteran 300-pound Bradley Hammer is used continuously, drawing down and reworking old high speed steel drills, reamers, etc., and making them over into cutting tools for use on the big automatics—salvaging hundreds of pounds of high speed steel every year.

Bradley Hammers are one-man tools of unusual range and versatility—big producers, but easy to operate, and always under instant control.

Let us tell you more about them and explain their application to your work

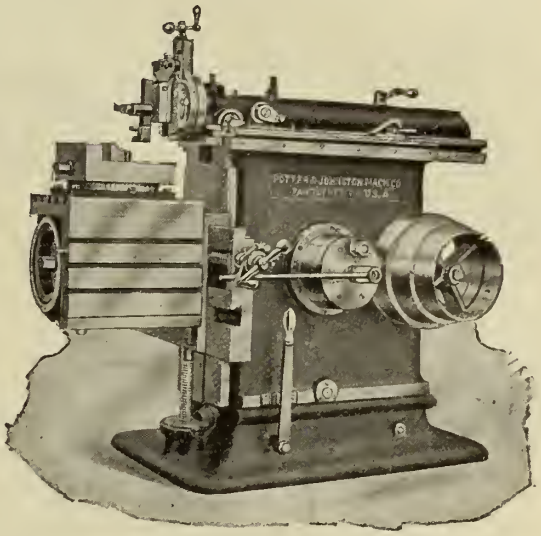
C. C. BRADLEY & SON, Inc., Syracuse, N.Y.

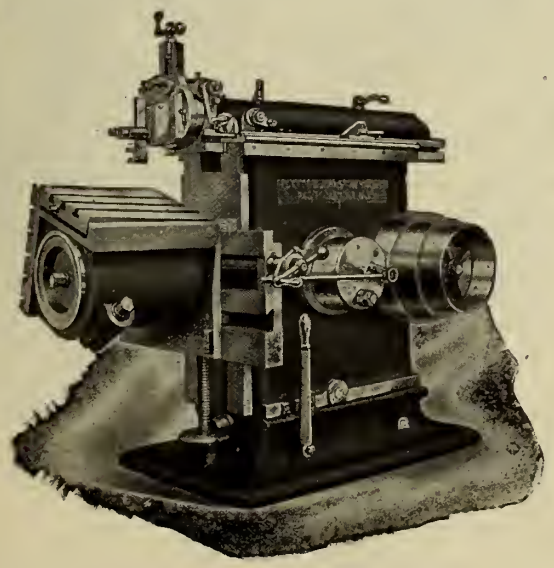
(ESTABLISHED 1832)

FOREIGN AGENTS:—England—Buck & Hickman, Ltd., London. **France**—Fenwick Freres & Co., Paris, Lyon, Rhone. **Italy**—Fenwick Freres & Co., Turin. **Belgium**—Fenwick Freres & Co., Liege. **Brazil**—Fenwick Freres & Co., Rio de Janeiro. **Switzerland**—Fenwick Freres & Co., Zurich. **Spain**—Fenwick Freres & Co., Barcelona. **Portugal**—Fenwick Freres & Co., Lisbon. **Alsace-Lorraine**—Fenwick Freres & Co., Luxemburg. **Norway, Sweden, Denmark**—Chr. A. Herstad, Copenhagen, Denmark. **China**—Anderson, Myer & Co., Ltd., Shanghai.

Universal Shaping Machines

No special vises or fixtures needed; the Universal features of these machines take care of everything, making them particularly adapted to—
Die Work
Tool Making and
General Manufacturing.





Machines regularly furnished with—

Swivelling Graduated Table.

Auxiliary Tilting Side for Compound Angles.

Power Down Feed on any angle, with any variation of feed.

Automatic Feed Stop.

Graduated Collars on Tool Head Feed Screw and Table Feed Screw.

Swivel Vise and Graduated Base.

Table raised and lowered by power on 24-inch size.

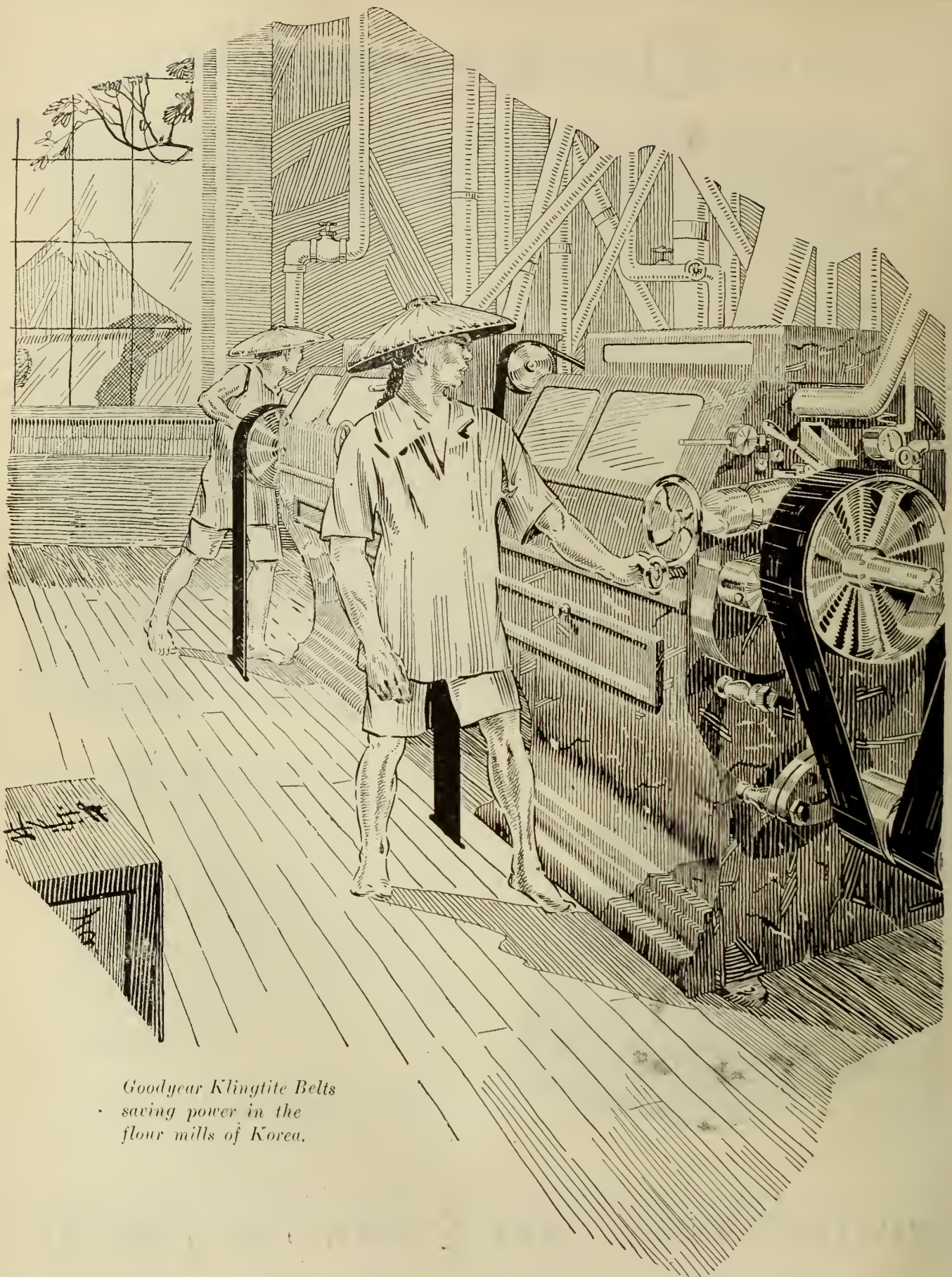
Canadian Offices: **POTTER & JOHNSTON MACHINE CO.**

ROELOFSON MACHINE & TOOL CO., LIMITED

Head Office and Show Rooms:

11 Wellington Street East - TORONTO, CANADA

If interested tear out this page and place with letters to be answered.



Goodyear Klingtite Belts saving power in the flour mills of Korea.

World-Wide Acceptance of Goodyear Belts

THERE is a world-wide acceptance of the Goodyear Belting which dominates in Canadian industry.

This direct endorsement of the Goodyear principles of manufacture and application gives us no little pride. It means that the technical men of the world see eye to eye with Canadians in the matter of economical and satisfactory power transmission.

But it means much more to Canadian industry. It means a world-wide fund of data for the Goodyear men who advise with you on belting problems. It means that the cotton spinners of Lancashire, the silk manufacturers of Lyons, the steel plants of Sweden, the shipyards of Seattle, the flour mills of the far East—all will contribute their experience to help solve power problems in Canada.

In order to meet world-wide market conditions it has been necessary to change some of the familiar Goodyear brand names—but the change is in name only.

For example, Goodyear Extra Power Belt is now Goodyear Klingtite Belt, and when the Goodyear belting man specifies Goodyear Klingtite for a certain drive you are getting the old Extra Power in every particular.

Ask any Goodyear branch to send a man who is making transmission problems his special study. No obligation. Phone, wire or write.

The Goodyear Tire & Rubber Co. of Canada, Limited

Branches: Halifax, St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, London, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Vancouver. Service stocks in other cities.

GOODYEAR BELTS

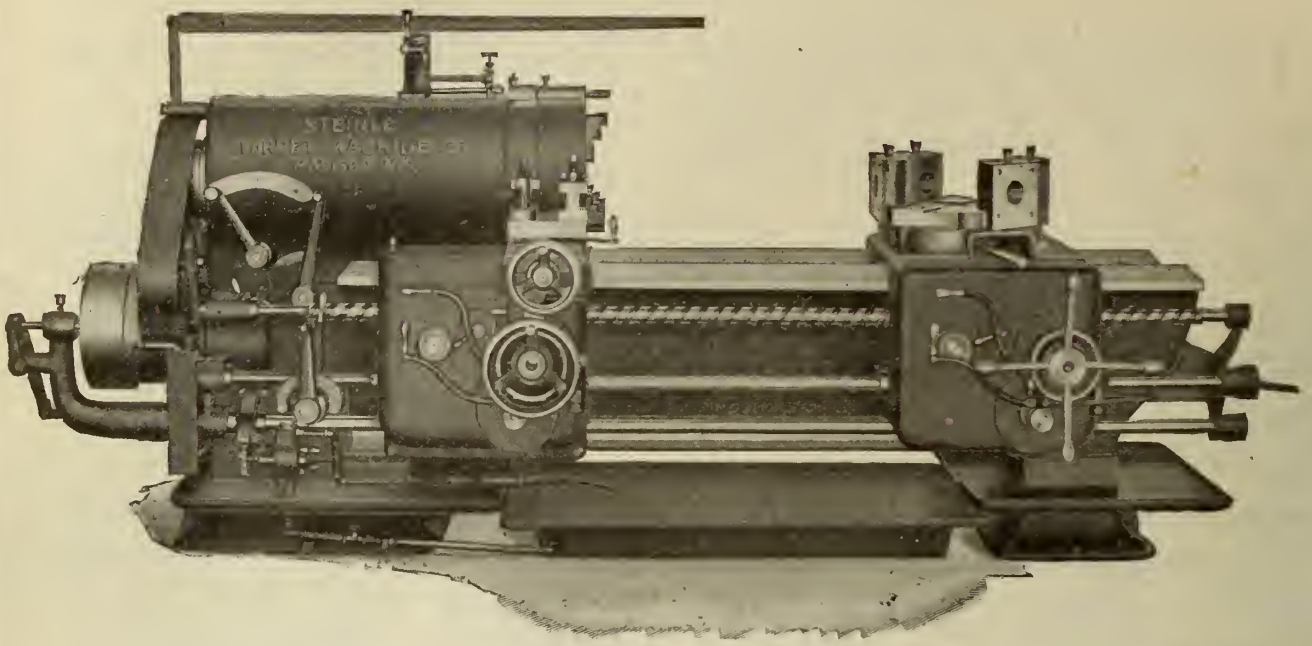
MADE IN CANADA

KLINGTITE GLIDE BLUE-STREAK

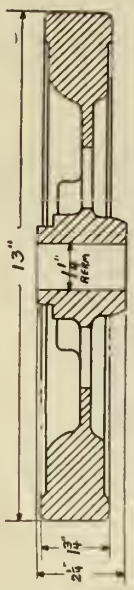
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STEINLE

Full Swing Side Carriage Turret Lathes



Time—Floor to Floor—6 Minutes Each



The Machine—A Standard Steinle 24" Lathe with 4" spindle bore arranged for belt drive and equipped with special boring bars and reamer for hub and with overhead turning device for rough turning rim on turret and with special three-cutter tool block on cross carriage for shaving rim, rounding corners and facing sides.

The Work—A cast iron flywheel 13" in diameter. Two cuts taken on all surfaces machined including boring of hub and turning, facing and rounding corners of rim.

Just another record of rapid production on a machine designed and built for fast severe service in producing accurate work economically. And this record is maintained not on one or two pieces but on lots of several hundred—just steady, consistent production under average shop conditions.

Do your records compare with this?

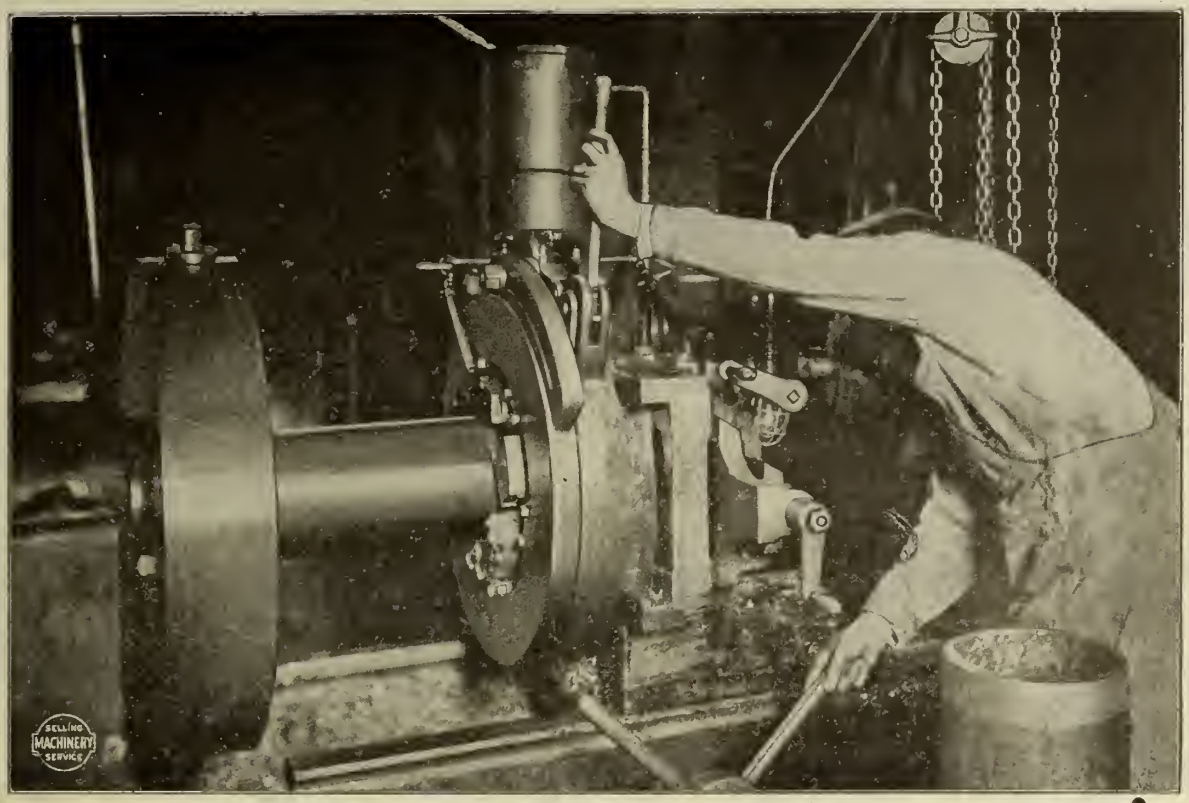
Why not send us your print of similar work and get our recommendations on production and tooling?

Steinle Turret Machine Company

Originator of the Full Swing Side Carriage Turret Lathe

Madison, Wis., U.S.A.

If interested tear out this page and place with letters to be answered.





One set of chasers covers the entire range of this head, a feature which alone effects an enormous saving in the cost of die maintenance. Landis Dies cut clean, accurate threads in any material, increase output and lower threading costs.

"We've threaded thousands of pieces on our Landis—and never lost a thread."

That is what the vice-president of the Keystone Supply & Mfg. Company, Philadelphia, Pa., said when asked what he thought about Landis Threading Machines. He also expressed the conviction that "The Landis Die is the only die."

The Keystone Company manufactures and deals in plumbing supplies of all kinds. The work is varied; requirements demand accuracy and speed. The five Landis Machines in use in this shop, threading work up to 8″ diameters, hold a record of never a single spoiled thread. The particular job snapped by the photographer shows one of the latest type Landis Die Heads cutting an 8″ pipe, 8 threads to the inch.

Landis Dies require no hobbing or retempering; lead is positive within the die; clearance is correct and automatically taken care of; rake can be ground to suit the material being ground.

NEW CATALOGUE WITH ALL DETAILS ON REQUEST

LANDIS MACHINE COMPANY, Inc.

Waynesboro, Pennsylvania, U.S.A.

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CANADA
FOUNDRIES & FORGINGS
LIMITED



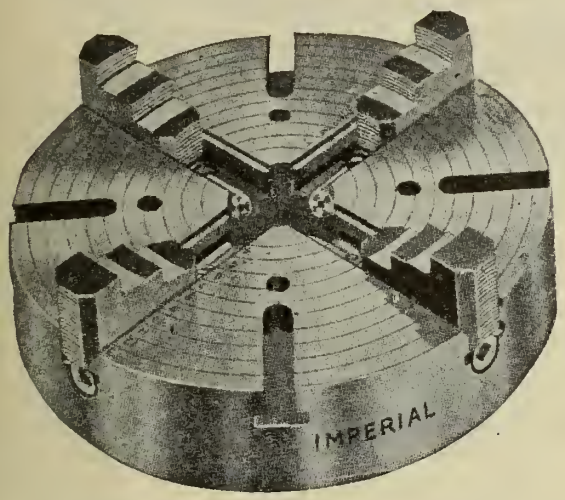
PRODUCED AT
JAMES SMART PLANT
BROCKVILLE, CANADA

IMPERIAL LATHE CHUCKS

Highly Endorsed by Canada's Best Manufacturers

Sturdy long-wearing "Made-in-Canada" Chucks that are making good everywhere.

Specify them in your next order.



Ker & Goodwin Machinery Co.
BRANTFORD, Ont. LIMITED

Harris Heavy Pressure

The Babbitt Metal that's at the Front in Efficiency and Economy



Order a Box from our nearest Factory

Our Guarantee is Back of Every Pound of Babbitt Metal We Make

Manufactured by

The Canada Metal Company, Limited

TORONTO - CANADA
HAMILTON WINNIPEG
MONTREAL VANCOUVER

Heat Under Accurate Control

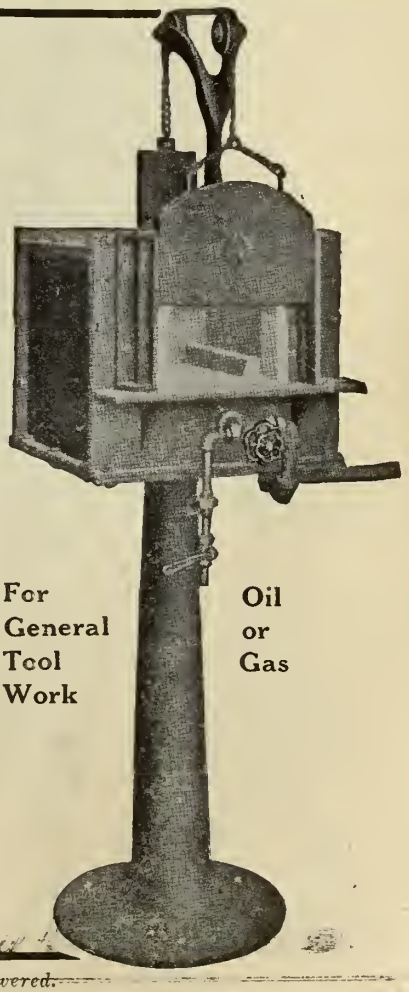
Here is an important factor in the heat treatment of metals. An intense heat, rapidly developed, and always under accurate control of the operator, are features that distinguish

BELLEVUE FURNACES

These tool forges are particularly adapted for the requirements of the small machine shop for annealing and tempering dies, cutters, reamers, etc.

Combustion is perfect and no flames come in contact with material. Built to stand the highest temperature. Doors are properly counterbalanced. In every way BELLEVUE FURNACES meet with the demand for durability, efficiency and convenience.

Let us advise you about your heat-treating problems



For General Tool Work

Oil or Gas

Bellevue Industrial Furnace Company

Julius C. Hinz, President

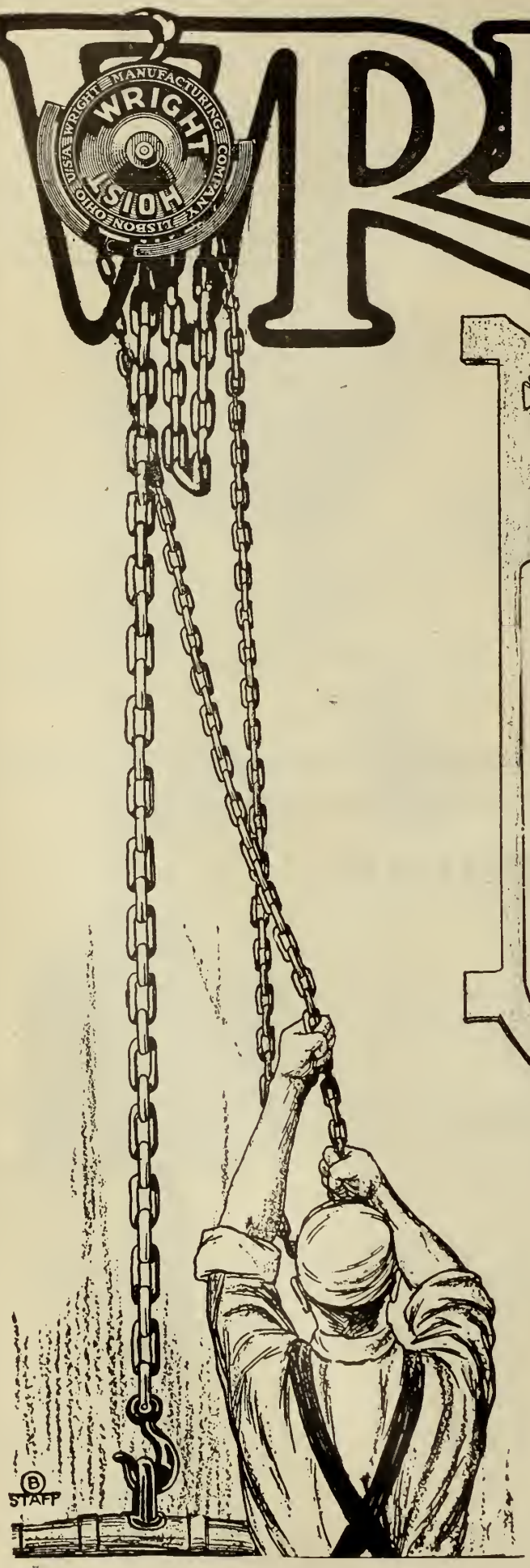
703 Bellevue Ave. - Detroit, Mich.

Representative in Canada: H. W. PETRIE, LIMITED, Toronto, Canada

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WRIGHT

HOIST



When you buy a hoist you want a *Wright,* because it is a specialist in strength, dependability and safety.

Made by the company that specializes in hoists.

WRIGHT MANUFACTURING COMPANY

LISBON, OHIO

Canadian Distribution

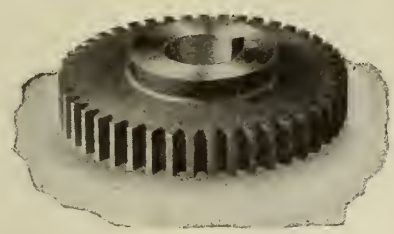
The A. R. Williams Machinery Co.

St. John, Halifax, Toronto, Winnipeg, Vancouver, Montreal

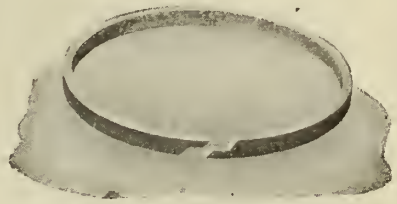
Do You Surface Grind Such Parts as These?



RACEWAYS
Also Thrust Washers
Flanges
Clutch Discs



GEARS
Or Gear Seats
Gear Hubs
Clutches



PISTON RINGS
Or Valve Seats
Valve Discs
Packing Rings

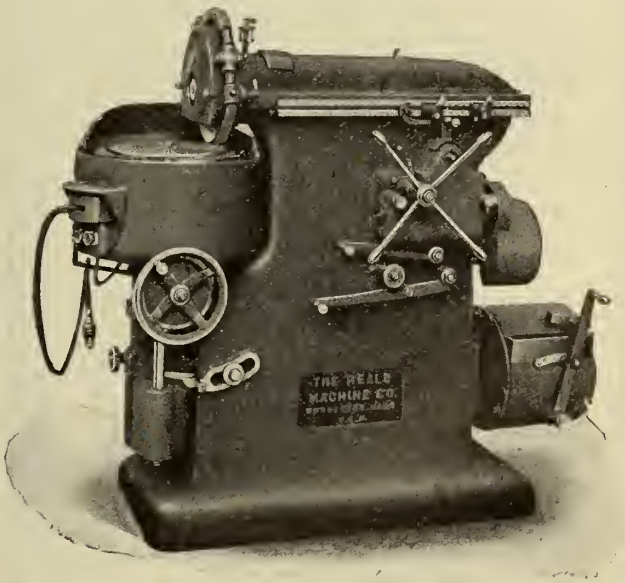
LET OUR ENGINEERING SERVICE DEPARTMENT FURNISH YOU DATA ON PRODUCTION FIGURES—WHEELS—METHODS OF HOLDING—CIRCUIT BREAKERS—SPEEDS—LIMITS—ON JUST SUCH WORK.

The New HEALD Rotary Surface Grinder

Designed for manufacturing purposes, built massive and simple with all necessary mechanical refinements to get various speeds and adjustments.

The pull of the spindle belt is downward, the only bearing requiring adjustment is the front bearing on the wheel slide. Three speeds to the slide and three to the chuck, which are independent of each other, grinding 10 degrees concave and convex.

Built in two sizes with 8 in. and 12 in. magnetic chuck.



Quick deliveries can be made.

THE HEALD MACHINE CO., Worcester, Mass.
51 NEW BOND STREET

AGENTS AND BRANCH OFFICES:

BRANCH OFFICES: New York, 839 Singer Bldg.; Philadelphia, 1308 Commonwealth Bldg.; Chicago, 26 South Jefferson St.; Detroit, 401 Marquette Bldg.; Cincinnati, 311 Provident Bank Bldg.; Cleveland, 721 Engineers' Bldg.

WESTERN AGENTS: Eccles & Smith Co., Los Angeles, San Francisco, and Portland; Salt Lake Hardware Co., Utah and Idaho.

FOREIGN AGENTS: Alfred Herbert, Ltd., England; Societe Anonyme Alfred Herbert, France, Switzerland; Societa Anonima Italiana Alfred Herbert, Italy; F. W. Horne Co., Japan; Wilh. Sonesson & Co., Sweden, Denmark and Norway; Henry Benedictus, Brussels, Belgium; American Machinery Syndicate, Spain and Portugal.

If interested tear out this page and place with letters to be answered.



You can speed up production with

LARCUL CUTTING OILS

If you are using ordinary cutting oils, Larcul positively will speed up production. This remarkable coolant enables you to run your machines at hitherto impossible speeds without overheating. It keeps the tool edge cool under all conditions. Result, longer runs without re-grinding—a gain in time that stands for a real saving.

LARCUL AMBER CUTTING OIL

A transparent cutting oil of the highest quality which, for some classes of work, produces an even smoother finish than can be obtained from lard oil. Gives absolutely satisfactory results on high carbon, vanadium, chrome nickel and tungsten steel.

LARCUL EBONY CUTTING OIL

A dark cutting oil that is unequalled for pipe threading, bolt threading, nut tapping, turrets and automatics, on open hearth, low and high carbon and alloy steels. Many of our customers claim that Larcul gives better results than lard oil.

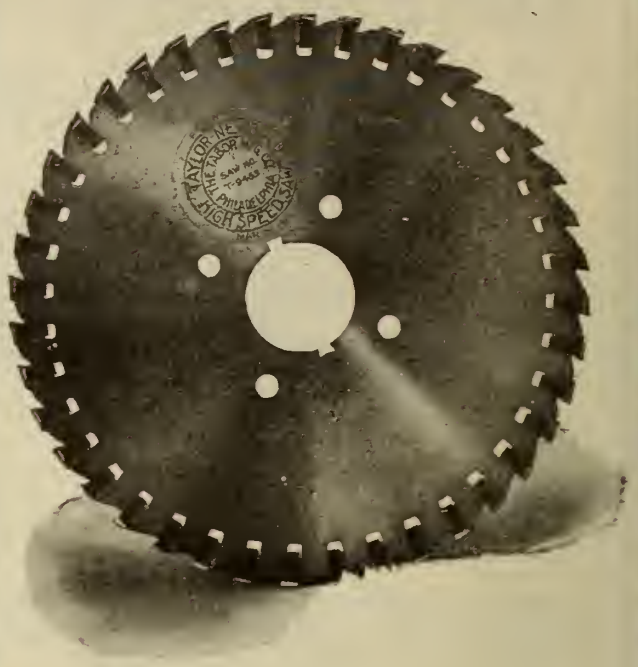
A Demonstration will be to your advantage. No obligation. Write to-day.

Cataract Refining Company
LIMITED

Toronto - Ontario

SCIENTIFIC LUBRICANTS for SCIENTIFIC LUBRICATION

THE IMPROVED
TAYLOR-NEWBOLD



INSERTED TOOTH COLD SAW
WRITE FOR BULLETIN T-S

Tabor Mfg. Co., Philadelphia, Pa., U.S.A.

1/3 to 1/2 Reduction in Milling Cost

This will be the result of taking small milling jobs from your big millers and putting them up to

The U.S. MILLER

The Miller for Small Work



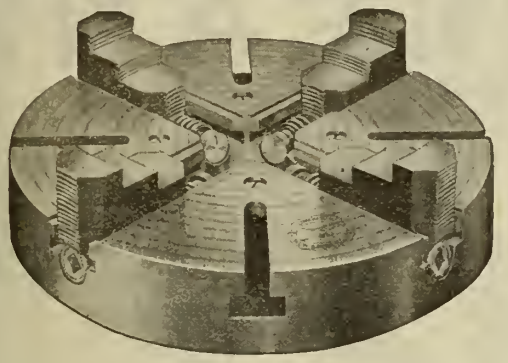
A small machine takes up less space, requires less power, is easier to operate and is more accurate.
The Paramount Miller of its size. Drop us a line for full details.

United States Machine Tool Company
Cincinnati, Ohio, U.S.A.

ALL STEEL

INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



THE UNION STEEL BODY CHUCKS

are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

UNION MANUFACTURING COMPANY

New Britain, Conn.

***New York Office:* 26 Cortlandt Street**

Makers of a complete line of chucks



Gray Iron and Semi-Steel Castings of all Descriptions

From 5 lbs. up to 4 tons

Foundry capacity, 15 tons per day.

Difficult castings our specialty.

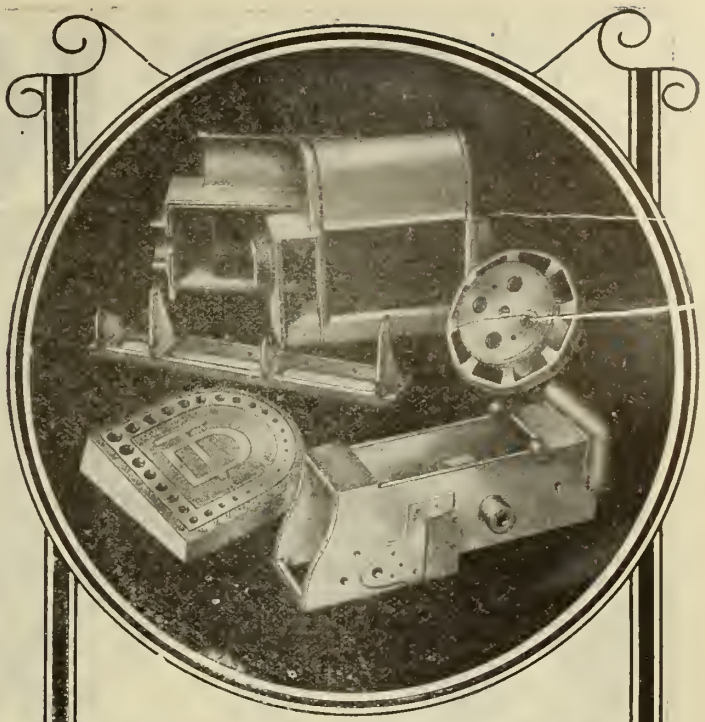
Mixtures regulated by chemical analysis and all castings sandblasted.

Estimates from blue prints submitted promptly.

If desired, we can make patterns to your drawings.

G. W. MacFarlane Engineering, Limited

Paris, Ontario



FRANKLIN DIE-CASTINGS

They Simplify Production and Reduce Costs

For nearly thirty years Franklin Die-Castings have aided the development of many fields of industry by reducing costs and simplifying production.

Wherever Franklin Die-Castings are adaptable they lower the cost of production through the saving of time, labor, equipment and material otherwise spent in machining.

Franklin Die-Casting methods often make it possible to produce a device in fewer parts. It is through such advantages, derived from the use of Franklin Die-Castings, that many products have been made commercially practical.

In 1892 we originated the die-casting industry. From our long experience, we can advise you whether the die-casting principle can be applied correctly and profitably to your special needs.

THE FRANKLIN DIE-CASTING CORPORATION
Gifford and Magnolia Streets SYRACUSE, N.Y.

We cast in Aluminum, Tin, Lead and Zinc base alloys. Estimates made from samples, drawings or blueprints.

Send for Booklet

OAKITE CLEANS



Rejects Decreased From 6 Per Cent. to 1-8 of 1 Per Cent.

THIS AUTO PLANT now cleans steel parts with Oakite materials instead of gasoline, and has cut down Japanning Room rejects from 6 per cent. to almost a perfect score of 1/8 of 1 per cent.

The cleaning operation consists of removing mineral oil from fenders, aprons, radiator shells, etc., before japanning.

Hand wiping with gasoline was slow. Moreover, the surface was so poorly cleaned with gasoline that the enamel failed to take properly on 6 per cent. of the work, and many parts had to be sanded and put through the enamel again at double the handling cost.

Now the work is cleaned with Oakite materials at the quick rate of one to six parts a minute, and with only one reject where formerly there were 48.

This advertisement is one of a series based on actual occurrences.

Oakite is non-inflammable. It will not injure hands, clothing or work. It is odorless. It is dependable.

May We Serve You Too?

OAKITE MANUFACTURED BY OAKLEY CHEMICAL CO. 44 THAMES STREET NEW YORK

MINISTRY OF MUNITIONS G R

The Disposal Board

Have

STOCKS

Lying in the United Kingdom and

AVAILABLE FOR EXPORT

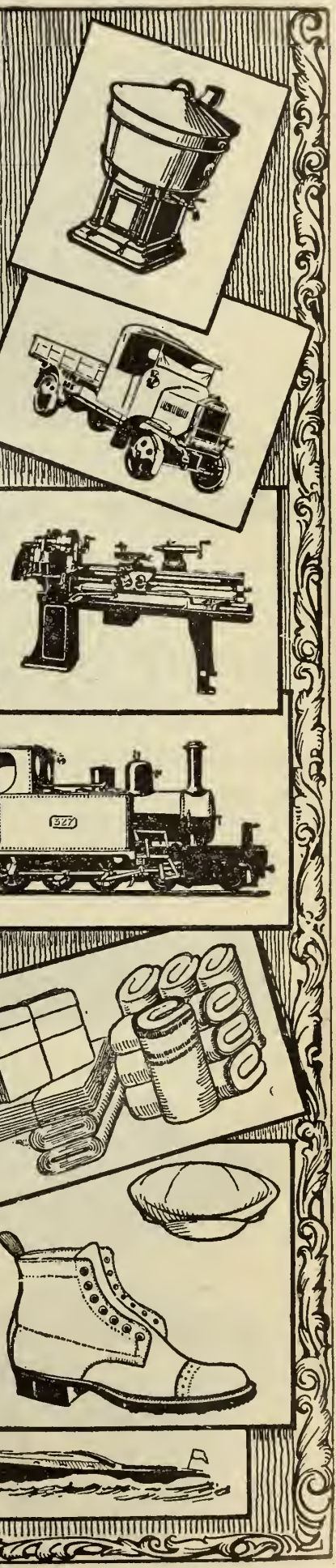
of

ENGINEERING STORES

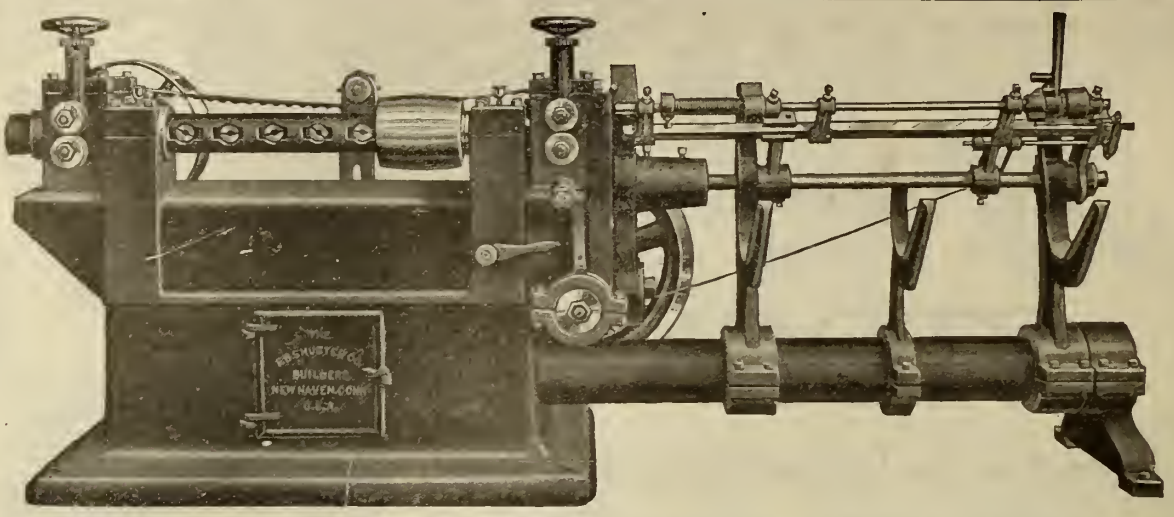
Ferrous and Non-Ferrous Metals
Plant and Machinery
Steam Engines and Boilers
Factory Store
Machine Tools
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Contractors' Stores
Electrical Instruments and Machinery
Medical Stores
Chemicals and Explosives
Motor Vehicles
Agricultural Machinery
Aircraft
Furniture
Textiles and Clothing
Motor Boats, etc., etc.
Boots and Leather Equipment, etc.

Buyers should instruct their representatives in the United Kingdom to communicate with The Secretary, Disposal Board, Ministry of Munitions, Caxton House, Tothill Street, London, S.W. 1.

Cable Address :
"DISPEXPORT, MUNORGIZE, LONDON."



If interested tear out this page and place with letters to be answered.



Perfect Wire Straightening Quickly and Profitably Done on Our

Automatic Wire Straightening and Cutting Machine

Just put your coil of wire on the reel, adjust the rolls and dies, and set the gauge for the length you want. The machine does the rest—thousands of feet per day, perfectly straight and cut to accurate lengths.

Catalogue tells more about them, and we will be glad to send you a copy.

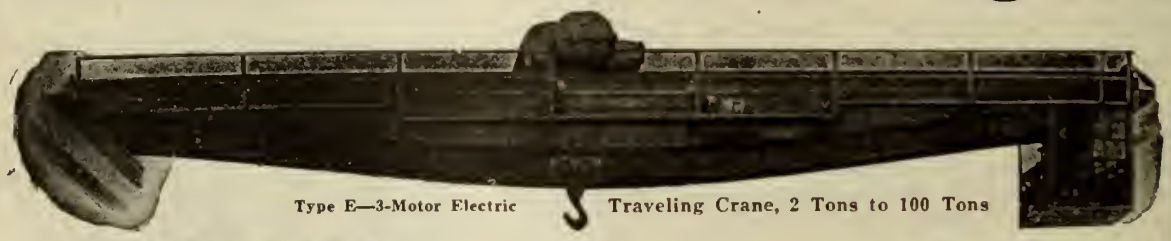
THE F. B. SHUSTER CO., New Haven, Conn.

FORMERLY JOHN ADT & SON ESTABLISHED 1886

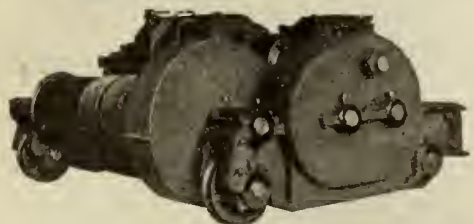
ALSO MAKERS OF STRAIGHTENERS FOR SQUARES, HEXAGONS, FLATS, ETC.

CANADIAN MADE CANADIAN MADE

Electric and Hand Traveling Cranes

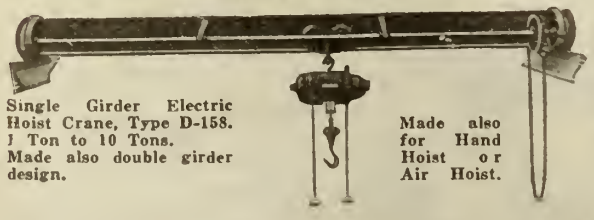


Type E—3-Motor Electric Traveling Crane, 2 Tons to 100 Tons



Northern Type E Crane Trolley, Rigid, Enclosed Construction. Patented in Canada.

We make a wide range of CRANE and HOIST designs. All sizes and capacities, 1 ton to 100 tons.



Single Girder Electric Hoist Crane, Type D-158. ½ Ton to 10 Tons. Made also double girder design.

Made also for Hand Hoist or Air Hoist.

Get our prices and specifications before you buy.

In asking prices, state SERVICE, CAPACITY, SIZE OR SPAN POWER, and, if electric, KIND OF CURRENT.

Catalogs free.



Type D Electric Hoists —½ to 10 Tons.

Air Hoists, Trolleys and Tracks.



Type No. 20 Air Hoist.

Northern Crane Works, Limited

Walkerville, Ontario, Canada



New Truths and Old Fallacies

Fusibility of Alloys—*Continued*

All intermediate grades of babbitts have the same fatal defect of low fusibility, as indicated below by figures of test made by the American Society for Testing Materials, and these figures apply as well to any composition that can be made within these limits:

Tin per cent.	Antimony per cent.	Lead per cent.	Copper per cent.	Melting Point
75	12	10	3	365 "
65	15	18	2	365° "
20	15	63½	1½	365° "

The melting point of these quaternary alloys is lower than those of binary or trinary alloys.

It is a common occurrence for technically educated men, holding high positions in railroad and commercial concerns, to adopt and publish as their standards, babbitt alloys of these low melting points. Very likely certain tests were undertaken before a decision was made, or they may have taken the word of some alleged expert, but the fact remains, nevertheless, that either Genuine Babbitt or the right grade of lead base babbitt would have given better and more economical service than these other mixtures, and this they could have discovered had they made the proper comparative tests and carried them to a definite determination.

In cases where thin, loose shell bearings are used and malleability is paramount to all other considerations, the use of Genuine is warranted; but in all other cases where the lining is anchored to the shell by recesses or soldering, a good lead base metal will give, by far, the best service, and this also applies to many patterns of bushings.

Continued next month.

For copy of complete article:

"New Truths and Old Fallacies"

Address our Montreal Office

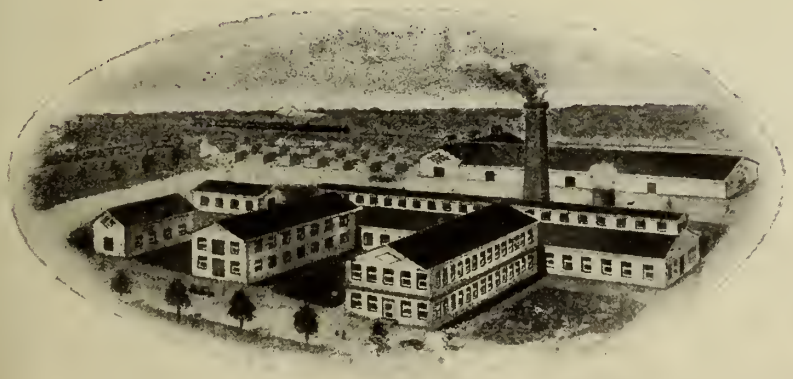
Sold by Leading Dealers Everywhere or by

Magnolia Metal Co. of Canada

Office and Factory:

37-39 Shannon Street, Montreal, Que.

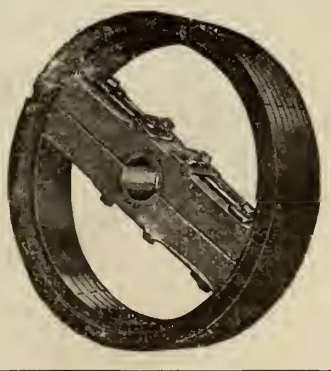
"BERNARD"
TRANSMISSION APPLIANCES



have achieved an enviable reputation in the Industrial World. Their performance under every conceivable working test has proved their dependability, and they are the most economical because of their durability.

We stand back of our products and will give Dealers every assistance.

Put them to the test.



The A. Bernard Industrial Co.

Manufacturers of High-Grade Power Transmission Appliances

Offices and Works: FORTIERVILLE, Que., Canada

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SPRINGS, WIRE & STEEL
EST.
"BARNES-MADE" PRODUCTS
1857
SCREW MACHINE PRODUCTS

ALL are—
"Barnes-Made" Products

High-Grade Springs

Clock or Phonograph, Brush Holder, Electrical Motor, Compression, Extension, Torsion, Machinery, Drop Forged, Special Small Flat, Milled, Wire and Auto Clutch Springs. We design and manufacture Springs for every purpose, according to specifications of steel, brass, phosphor bronze or vanadium.

Screw Machine Products

Made to order up to 1 5/16 inches in diameter, from steel, brass or any metal. In plain, plated, case-hardened or any other finish—regardless of quantity or exacting requirements.

Washers, Stampings, etc.

Spring Washers made to order only—from Spring steel, brass or phosphor bronze. Unusually complete facilities insure quick work. Orders for small press work and simple stampings handled economically.

Cold Rolled Steel

"Barnes-Made" High Carbon Cold Rolled Spring Steel for phonograph, clock and general spring purposes. ½ inch to 4 inches in width, annealed, black tempered or polished and colored. Accurately rolled to gauge from the highest quality rods.

Just Specify—We'll Supply

The Wallace Barnes Company

"Spring Makers for Three Generations"

Main Office and Works - Bristol, Conn.

Western Sales Division, Book Bldg., Detroit.



You can tell they use-

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THE CLEVELAND TWIST DRILL CO., Cleveland, New York, Chicago

Agents for Europe, CLEVELAND TWIST DRILL CO. (GREAT BRITAIN), Ltd., 36-37 Upper Thames St., London E.C.4.

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MADE
IN CANADA

MALLEABLE AND CAST IRON PIPE FITTINGS

Annual Capacity
6000 Tons

Quality Products

Prompt Service

M Brand Pipe Fittings, Screwed or Flanged, Black or Galvanized.

We are equipped to make the general run of malleable and grey iron castings for machinery manufacturers, agricultural implements, automobiles and specialties.

Cast Iron Fittings
stamped with our trade-mark mean fittings made with iron of high tensile strength — proper proportions and correct tappings.

RECESSED DRAINAGE FITTINGS

Malleable Fittings
of our brand mean fittings made of *Air Furnace Refined Iron*, reamed and tapped to gauge with perfect threads.

A trial of our pipe fittings will prove the quality of service they give.

International Malleable Iron Company, Limited
GUELPH, CANADA

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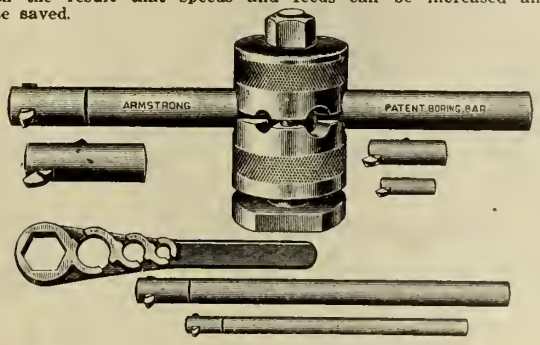
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Armstrong 3-Bar Boring Tool

A slight turn of one nut releases or fastens both Bar and Holder.

Bars can be changed as needed almost instantly, thus allowing the operator to use the stiffest bar possible for each job, with the result that speeds and feeds can be increased and time saved.

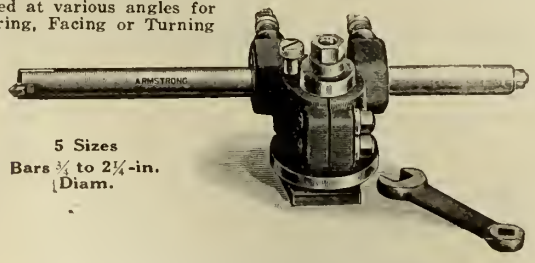


No. of Tool	1-B	2-B	3-B	4-B
Diam. Bars.	½, ¾, 1⅛	9/16, 15/16, 1 5/16	¾, 1⅛, 1½	15/16, 1 5/16, 1 13/16
Length Bars	8, 11, 16	9, 13, 18	11, 16, 21	13, 18, 24
Size Cutters.	3/16, ¼, 5/8	3/16, 5/16, 7/16	¼, 3/8, ½	5/16, 7/16, 5/8
For Lathes.	14 to 16	16 to 18	20 to 22	24 to 32

Adjustable Boring Tool

Patented

This tool combines Convenience, Adjustability and Rigidity to a remarkable degree and is well adapted to a very wide range of work. The holder is easily adjustable to different heights and will hold bars of various diameters. The Bars are made from high carbon steel seamless tubing of heavy gauge and are extremely stiff. The cutter can be adjusted and solidly fixed at various angles for Boring, Facing or Turning



5 Sizes
Bars ¾ to 2¼-in. Diam.

NEW CATALOGUE B-20 FREE

Canadian Agents—Williams & Wilson, Montreal; A. R. Williams Machinery Co., Toronto, Winnipeg, Vancouver, St. John.

ARMSTRONG BROS. TOOL CO.
"THE TOOL HOLDER PEOPLE"
335 N. FRANCISCO AVE. CHICAGO U.S.A.
STRONG STRONG

MacKINNON STEEL CO., LTD.

Engineers, Manufacturers and Erectors of Steel Structures

Industrial Bridges, Buildings, Towers, Smoke Flues and Stacks, Chutes, Coal Bins, Ore Bins, Tanks, Cranes, Engine Houses, Grain Elevators, Derricks.

Structural Steel and Steel Plate Work, and a combination of the two lines.

Prompt Deliveries Assured

MacKINNON STEEL CO., LIMITED
Sherbrooke, Quebec
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STEEL CASTINGS

We shall be glad to supply information on:

Galvanizing, Enamelled Signs, Stoves, Lithographed Ware, Wire Goods, Anchors, etc.

For Shipbuilding, cars, locomotives, and all classes of machinery.

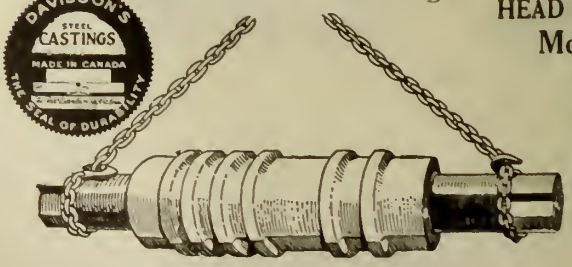
Superior and reliable Steel Castings by the Acid Electric Process can be made up to fifteen tons.

The Thos Davidson Mfg. Co Limited

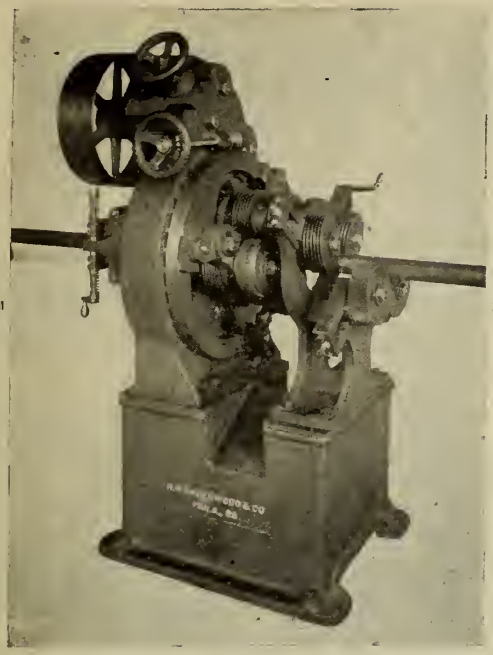
HEAD OFFICE: Montreal

Branches: Toronto and Winnipeg

Steel Foundry Division
Lachine Canal
Turcot.



DAVIDSON



No. 1
1½ to 3"
Flues

No. 2
3 to 6"
Flues

Rotary Flue Cleaning Machine

Built in 2 sizes

For removing scale or crust from boiler flues this machine is without equal. It requires very little power and will clean from eight to ten feet per minute, removing all scale and without injury to the flue. It is easily operated, is strong in all its parts and will ably stand the hard work it is designed to do. Full particulars of this or any other Underwood machine will be forwarded on request.

H. B. UNDERWOOD CORPORATION
1025 Hamilton St. Philadelphia, Pa., U.S.A.

STEEL CASTINGS

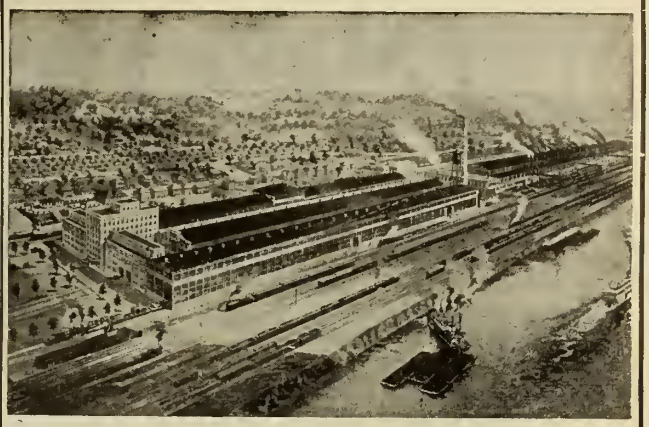
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Manganese Steel
Chrome Steel
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QUALITY GUARANTEED

Sizes—½ lb. to 5,000 lbs. each

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LIMITED
OWEN SOUND, ONTARIO
ESTABLISHED 1860



MESTA MACHINE COMPANY
General Office and Works: Pittsburgh, Pa., U.S.A.

GAS AND STEAM ENGINES

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Blast Furnaces, Rolling Mills
Power Plants
Gear Drives, Rope Drives, Condensers
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ROLLING MILL MACHINERY

Blooming Mills	Tin Plate Mills
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Roll Lathes
Chilled, Sand, Steel and Special Rolls
Rolling Mill Pinions and Gear Drives

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Steam Hydraulic Forging Presses
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Pickling Machines Metal Mixers
Iron and Steel Cut Gears
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Large Engine Shafts—Piston Rods
Ship Shafts General Forgings

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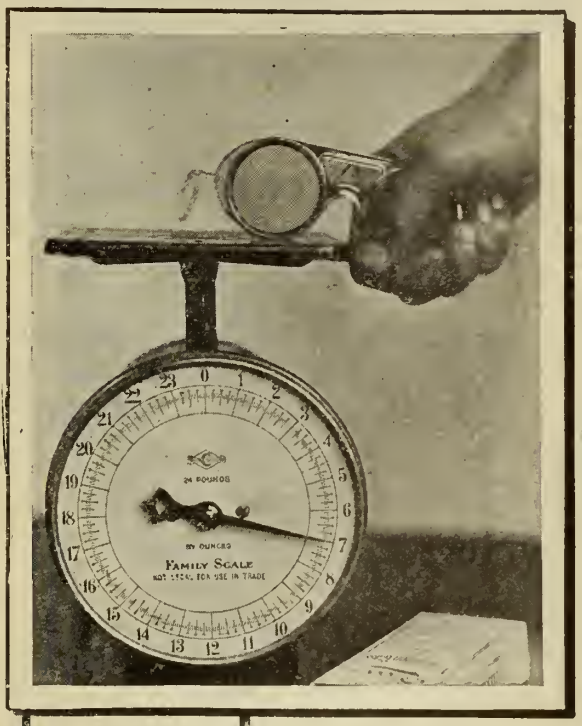
Carbon Steel—Alloy Steel—Bronze
Air Furnace Iron Castings
Carbon and Alloy Steel Forging Ingots

Write for Bulletins

MESTA MACHINE CO.
Pittsburgh, Pa. U.S.A.

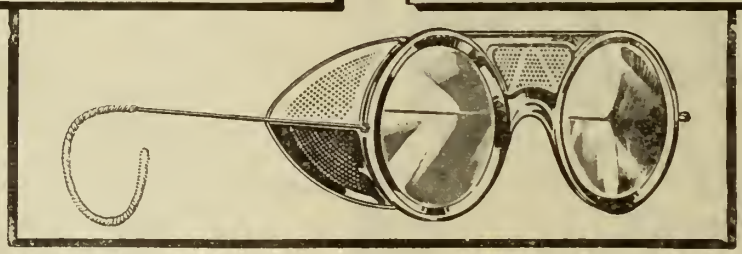
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You Make These Two Tests of STOCO SAFETY GOGGLES





Test No. 1. Similar to test in proposed eye protection code of Bureau of Standards which calls for 4 lbs. pressure without permanent distortion of frame. Unretouched photo shows STOCO Safety Goggle standing 7 lbs. pressure.



Test No. 2. Similar to test in proposed eye protection code of Bureau of Standards which calls for 8 oz. pressure without permanent distortion of frame. Unretouched photo shows STOCO Safety Goggle standing 4 lbs. pressure.

These two tests, which anyone may make, show conclusively the strength and rigidity of the one-piece front construction of the STOCO Safety Goggle and indicate the service this protection glass will give under the abuse of shop wear.

In spite of this unusual strength the STOCO Safety Goggle is no heavier than other protection glasses of much less substantial construction and may be worn long hours at a stretch without discomfort.

If you are interested in and responsible in any way for the prevention of industrial eye accidents ask us on your own—or your firm's letterhead for a sample STOCO Safety Goggle. There will be no charge.

Price per Hundred.
(F.O.B. Geneva, N.Y.)

With Optical Glass Lenses $90.00
With Celoglas Shatter-Proof Lenses $115.00

Easy cable earbows or black elastic headbands at same price.
Discounts for quantity orders.

THE STANDARD OPTICAL CO.
GENEVA, N.Y. U.S.A.



Chrome-Nickel-Molybdenum
Chrome-Vanadium
Chrome-Molybdenum
Special Chrome-Nickel
Chrome Nickel

After All, a Crankshaft Can be no better than the Steel from which it is made—

Our experience in alloy steel manufacture enables us to furnish the proper quality for all classes of Crankshafts—Aeroplane, Automobile, Truck or Tractor. We can supply the steel best suited to your needs.

Avail yourself of our expert consultatory service.

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The largest selling quality pencil in the world

VENUS PENCILS

FOR thin delicate lines to heavy shading — for sketches to designs of intricate and costly machinery—for rough charts or finished maps—VENUS Pencils are supreme. Depended upon by engineers everywhere, VENUS Pencils are termed "pencils of precision"—perfect for the engineer's every pencil purpose.

17 black degrees, 3 copying

For bold heavy lines, 6B-5B-4B-3B
For general writing and sketching, 2B-B-HB-F-H
For clean fine lines, 2H-3H-4H-5H-6H
For delicate thin lines, 7H-8H-9H

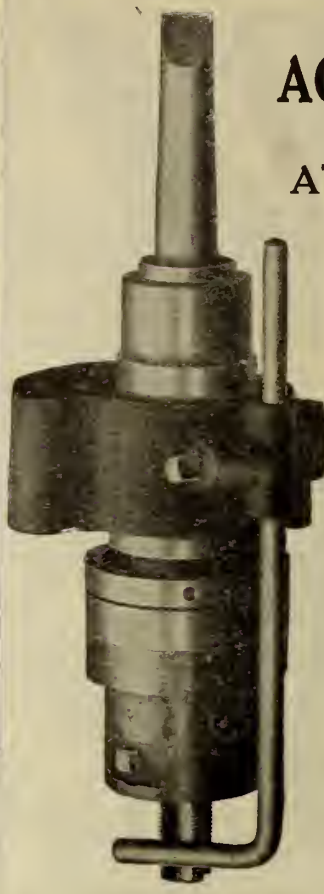
The most popular degrees for drafting are 2H, 4H, and 6H.

Plain ends, per doz. $1.50
Rubber ends, per doz. $1.75

American Lead Pencil Co.
238 Fifth Ave., New York
Factory, Hoboken, U.S.A.
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VENUS

At stationers and stores throughout the world.



THE
ACKWORTHIE
TAPPING ATTACHMENT.

BRITAIN'S PREMIER CHUCK

Made in 6 sizes.
To tap from ⅛ in. to 1¼ in. Whit.

We have made some thousands of these Chucks during the last 11 years, every one of which has given satisfaction. For tapping holes there is nothing to equal them for speed and handiness.

Shall we mail you particulars?

J. ACKWORTHIE, Ltd.
Coleshill Street,
BIRMINGHAM

Dunbar

Springs *for* Every Use

We have been making springs of all kinds for 70 years. Let us advise you when in difficulty.



Tell us the purpose for which the spring is intended, and experts will gladly co-operate to see that you get the design best suited to the purpose.

Dunbar Springs are thoroughly tested for **accuracy** and **quality**. Send us specifications, for estimates.

THE DUNBAR BROS. CO.
BRISTOL, CONN.

HOLD TITE NUT LOCK

See How Easily Applied



Knowing the size Bolt—use same size Nut Lock. Place over Bolt—as shown above.



Screw another Nut onto Nut Lock and Depress it — as shown above.



Remove Second Nut and Nut Lock will Look — as shown above.

The Hold Tite Nut Lock cannot come loose when it is compressed into the thread of the Bolt. Compressing will not destroy the thread.

Head Office:

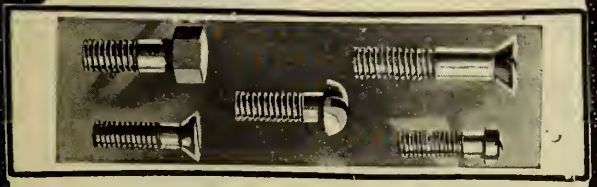
Edward A. Robinson Co., Ltd.

228 Craig St. West, MONTREAL, Que.

Branch Office: Bank of Toronto Chambers, 205 Yonge St., Room 32, Toronto, Ont.
U.S.A. Office: 166 Montague St., Brooklyn, N.Y.

Wood Screw Making Machinery

SEND FOR CATALOGUE
Series



For sixty years we have constantly manufactured machinery for making screws, always studying to improve and refine our product.

Write or Wire us.

Cable address: "Cook,"
Hartford, U.S.A.
Codes: Liebers
Western Union

Asa S. Cook Co.
Hartford, Conn.

DOMINION GRINDING WHEELS



Test Dominion Wheels Against the Best Imported Quality

If you have been skeptical of the merit of Canadian-made grinding wheels in the past, do not let that prevent you from giving Dominion wheels an opportunity of proving their superiority.

Since we have commenced making Dominion wheels from our own abrasives, their uniform quality is rapidly removing the stigma from Canadian wheels throughout the whole country. Give them their chance with you.

Dominion Abrasive Wheel Co., Ltd.
Mimico - Ontario

The Greenfield

Universal Grinder

An all-round machine for your tool room

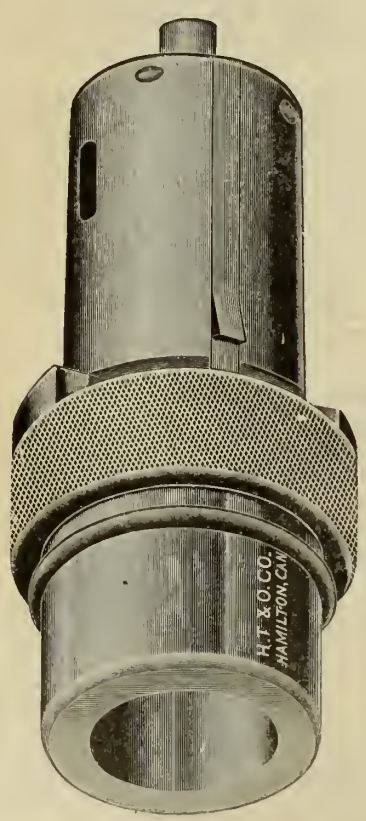
Equipped with attachments for the grinding of milling cutters, reamers, taps, etc., and capable of handling cylindrical, internal and surface grinding, the Greenfield is truly an all-round tool-room machine.

The attachments are all very simple in design and easily adjusted upon the machine, being graduated so that any desired angles can be at once obtained.

The head is made from a solid casting and embodies rigid arch construction. Spindle turns in large bronze bearings without vibration. Write for full particulars.



Greenfield Machine Company
GREENFIELD, MASS., U.S.A.



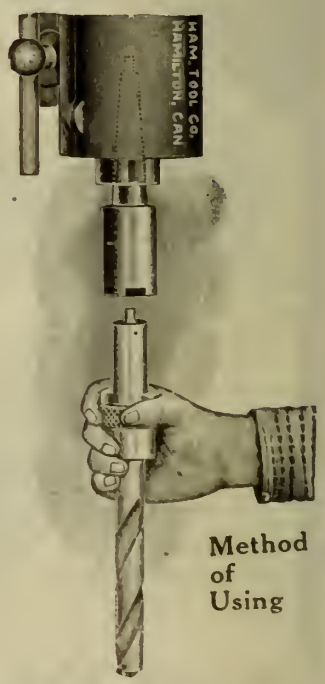
THE BEAVER CHUCK AND COLLET

A Real Time-Saver!

With the Beaver Chuck and Collet you can interchange your drills, reamers, counterbores, etc., **without stopping the machine!** The change is made easily, with the use of hammer, wrench or key. One hand is enough! A self-contained device releases collet and tool instantly.

The Beaver Chuck and Collet converts a single spindle into what is practically a multiple spindle machine. Think of the time you will save! As many tools on one machine as you have operations on any piece of work.

Write for full particulars.



Method of Using

The Hamilton Tool Co., Limited, Hamilton, Ont.

STEEL CASTINGS

Any Analysis

D

Any Size

Dominion Foundries & Steel, Ltd.
HAMILTON, CANADA

"MORSE" Drills



ARE DESIGNED FOR DRILLING

Straight, Accurate Holes

AND THEY DO IT WITHOUT STINT

For Quality and Quantity Production

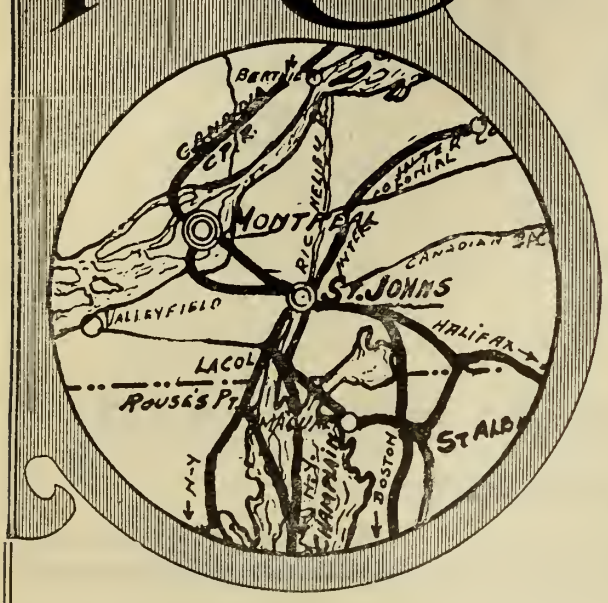
USE "MORSE"

MORSE TWIST DRILL & MACHINE COMPANY

NEW BEDFORD, MASS., U.S.A.

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The City of ST. JOHNS, QUEBEC



Offers To Manufacturers—

A Cash Bonus On Your Payroll, Exemption From Taxes, Etc.

Already a busy industrial centre, St. Johns is rapidly expanding and now offers unparalleled inducements to encourage the establishment of new industries.

Every new industry is exempt from taxation for a period of fifteen years, such period being subject to extension. A bonus of 5 per cent. will be paid on your payroll for a period of five years. If you desire it, the city will advance this to you to be applied to the purchase or erection of any building suitable to your purpose. All public improvements you may require, such as street extensions, sidewalks, waterworks and sewage will be attended to by the city.

In addition to these inducements, St. Johns enjoys one of the finest industrial locations in Canada; has unequalled transportation facilities, an adequate fuel, power and labour supply, making it an unusual industrial opportunity.

No Other City Can Offer These Combined Advantages

Seven railroads, including Canada's great transcontinental lines.

Finest ocean shipping facilities.

Canal connections with New York, the Eastern States and the Great Lakes.

Cheapest labour market in Canada.

Plentiful supply of skilled and unskilled labour.

Cheap and abundant electric power.

Cheap coal and lower freight rates.

Desirable factory sites with all public conveniences immediately available.

Extraordinary inducements to new industries.

For more specific information write to

The Secretary of the City Council

ST. JOHNS, QUEBEC, CANADA

THE NASTER METAL ■ THE MASTER METAL

STELLITE

Not Steel—but its master

Every manufacturer knows that lathe tools of high speed steel cannot be worked too fast—the cutting edge burns and crumbles when it becomes too hot.

This is the condition which **Stellite** successfully combats. **Stellite** becomes tougher the hotter it gets, up to 2,000 deg. F.!

This is the great factor of **Stellite** economy. **Stellite** permits cutting speeds never before known in lathe history.

Let us send a demonstrator and show you just what **Stellite** can accomplish on **your** work.

DELORO
Smelting & Refining
Company Limited

Head Office and Works: DELORO, CANADA

Branch Warehouses:
200 King St. W., Toronto, Ont., Can.
26 Abermarle St., London, Eng.

THE MASTER METAL ■ THE MASTER METAL

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Announcing



the issuance of a new catalog of prime interest to all users of milling and gear cutters and small tools. Herein you will find listed styles and sizes of end mills (special and plain) T-slot cutters. Key cutters, thread mills, gear slots—in fact your needs in the small tool line of this class are sure to be covered. Get your copy and note its completeness.

If your special requirement doesn't appear, Bilton can produce it—and in true Bilton Quality.

Just sign your name and address on a card and post it to

The Bilton Machine Tool Company
Housatonic Ave., Bridgeport, Conn.

ELECTRIC STEEL AND ENGINEERING, LIMITED *Head Office:* **Welland, Ont.**

Works

ELECTRIC STEEL & METALS COMPANY, LIMITED, Welland, Ont.

Steel Castings
of Any Analysis
Carbon, Manganese, Nickel, Chrome and Forging Ingots, etc.

WABI IRON WORKS COMPANY, LIMITED, New Liskeard, Ont.

Mining Machinery
Iron Castings, Crushers, Rolls, Tanks, Pumps, etc.

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Turbine Water Wheels
Pumps for pulp and paper mills, Pumping Engines for municipal purposes, Centrifugal Pumps.

"Alloyed in Canada under the world-famed Stanley Process"

Lionroyal

We warrant that no other Babbitt at the price will perform as well in so many different classes of bearings, and are ready to prove this in any case by trial installations in competition with any metal of its type.

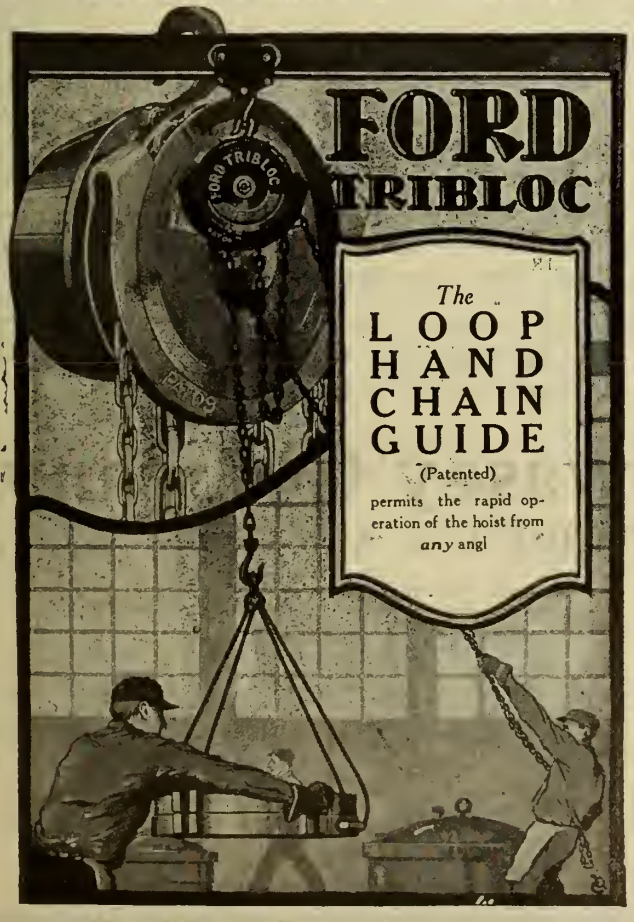
The Dependable BABBITT



For General Service

BRITISH SMELTING & REFINING COMPANY LIMITED

MONTREAL and LONDON, ENGLAND



CONFIDENCE

is a big factor in speedy production.

When your Workman feels that he can run the chain hoist at any speed and from any angle without the hand chain binding, gagging, or over-riding the flange—

That Workman is going to give more attention to the work in hand—the work you make your money out of.

The FORD TRIBLOC is made to stand up under rough service—and does.

Capacities: Half a ton to twenty—and more.

Catalog: Interesting—if you want economical lifting and carrying.

We'll send you a copy if you say so.

2175-D

FORD CHAIN BLOCK CO.
2ND & DIAMOND STREETS PHILADELPHIA, PA.

OVER-SEAS REPRESENTATIVE
ALMACOA ALLIED MACHINERY COMPANY OF AMERICA ALMACOA
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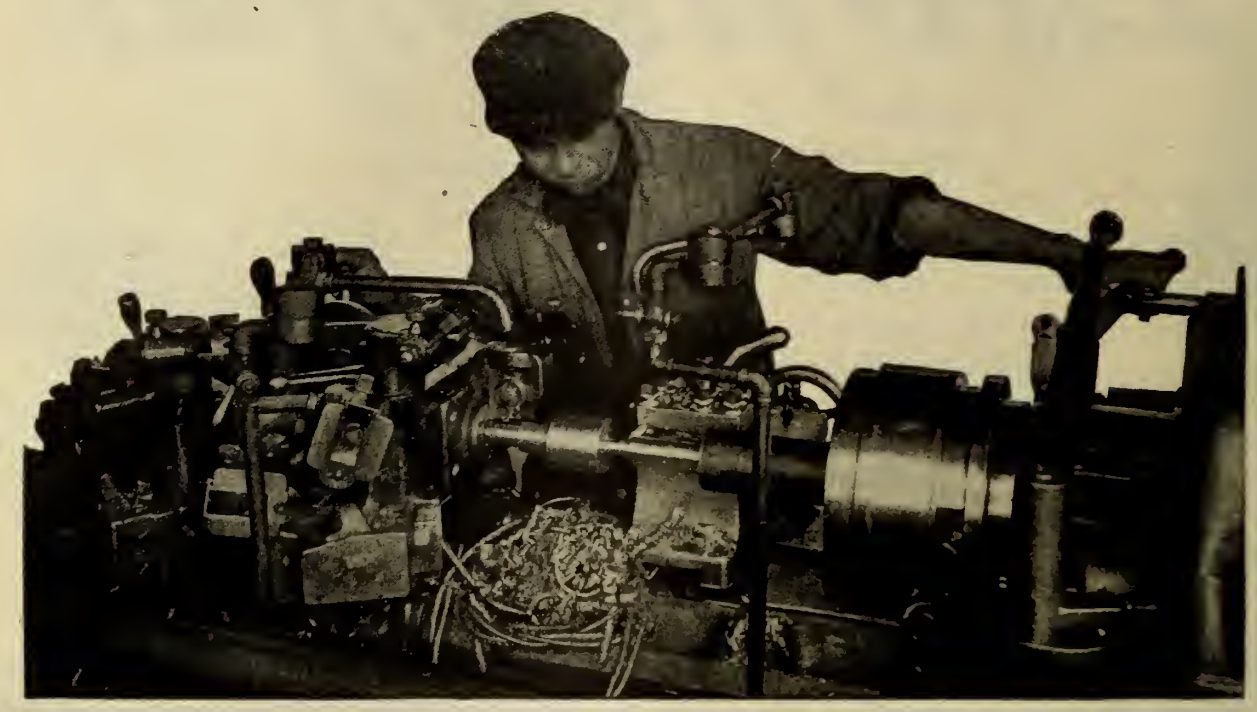
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W & S Turret Lathes in Operation

at the

Master Mechanics and Master Car Builders Convention

Young's Million Dollar Pier, Atlantic City, N. J., June 9 to 16 Spaces 145 to 147



Here's an opportunity to compare what a W & S turret lathe can do with what is being done in your own shop.

We're showing three turret lathes in operation at the M. M. & M. C. B. Convention this year—

A No. 2A on a bar job (picture above)
A No. 3A finishing a gear blank.
A No. 6 machining a clutch cone
and Stellite cutting tools on two of the machines.

You can get up close to the turret lathes and see them work—You can examine the work itself as closely as you like—You can ask questions about your own work—We send men to these conventions who know W & S turret lathes and they like to be quizzed—so bring a list of questions if you like—The more the merrier.

If you're not going to be in Atlantic City during that time, write for our new booklet "Turret Lathes in Railroad Shops."

The Warner & Swasey Company

CLEVELAND, OHIO, U. S. A.

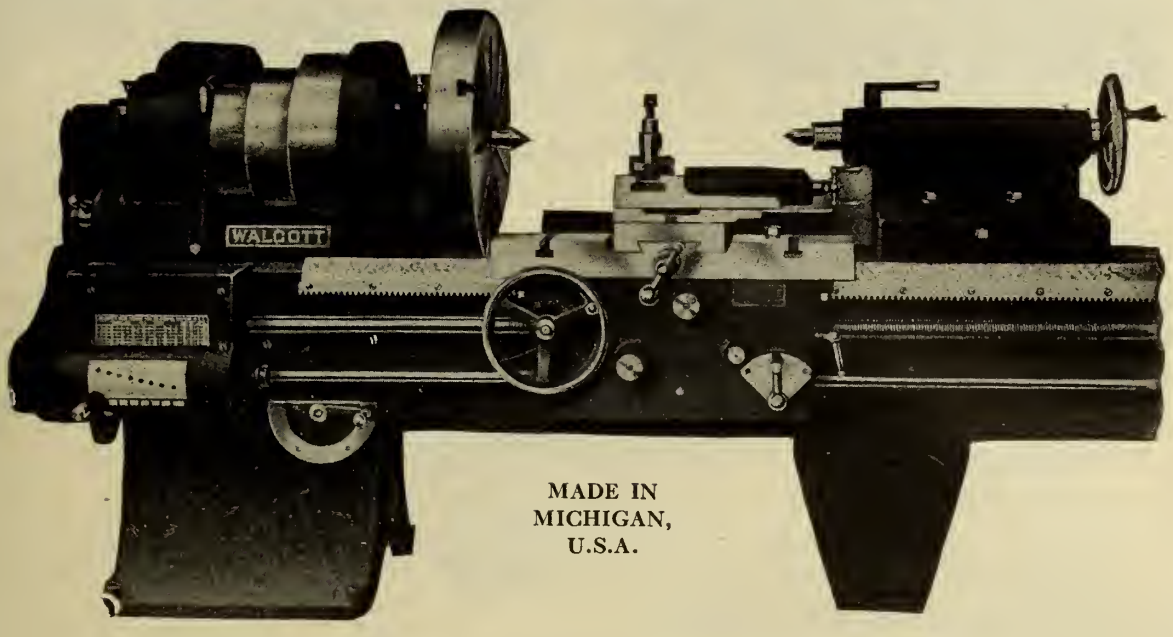
NEW YORK OFFICE: Singer Building.
BOSTON OFFICE: Oliver Building.
BUFFALO OFFICE: Iroquois Building.
DETROIT OFFICE: Ford Building.
CHICAGO OFFICE AND SHOW ROOMS: 618-622 Washington Blvd.

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Young & Vann Supply Company, Birmingham, Ala.
Woodward, Wight & Company, New Orleans, La.
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Smith-Booth-Usher Company, Los Angeles, Calif.
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Portland Machinery Company, Los Angeles, Calif.
Fred Ward & Son, San Francisco, Calif.
Portland Machinery Company, Portland, Oregon.
Hallidie Machinery Company, Seattle, Wash.
Hendrie & Bolthoff Mfg. & Supply Company Denver, Col.
Peden Iron & Steel Company, Houston, Texas.

CANADINA AGENTS:
A. R. Williams, Machinery Company, Ltd., Toronto, Winnipeg, Vancouver, St. John's.
Williams & Wilson, Ltd., Montreal.

FOREIGN AGENTS:
Charles Churchill & Company, Ltd., London, Birmingham, Manchester, Bristol, Newcastle-on-Tyne, Glasgow.
Allied Machinery Company, Paris, Turin, Zurich, Barcelona, Brussels
Wilhelm Sonesson Company, Malmo, Copenhagen, Stockholm, Goteborg.
R. S. Stockvis en Zonen, Rotterdam.
Benson Brothers, Sydney, Melbourne, Adelaide.
Yamatake & Company, Tokyo.
McLeod & Company, Calcutta
Anderson, Meyer & Company, Ltd., Shanghai, Tientsin, Pekin, Hankow, Canton, Yumanfu, Changau, Kalgan.
Brossard-Mopin & Company, Saigon, Singapore, Haiphong.

WALCOTT



MADE IN
MICHIGAN,
U.S.A.

THE ACID TEST

The ability of a lathe to deliver the highest type of production service is the acid test for its value.

For 39 years critical buyers have expressed their preference for Walcott Engine Lathes.

Excellence of design, strength, high quality of material and workmanship, accuracy — all are embodied in a Walcott.

Sizes 14" to 29" inclusive.

Ask a Walcott Owner,
Then Let Us Quote You

WALCOTT LATHE COMPANY

135 Calhoun St. *Established 1881* **Jackson, Mich.**

Canadian Agents : The Canadian Fairbanks-Morse Co., Ltd., Montreal, Toronto, Ottawa, St. John, N.B., Winnipeg, Calgary, Saskatoon, Vancouver, Victoria

If interested tear out this page and place with letters to be answered.

Concerning the Hangers in Your Plant

ARE they fitted with ordinary friction-producing bearings that cut down production, waste fuel, and eat into your dividends?

And if so, are you aware that the large loss involved can be largely eliminated by installing S K F BALL BEARING HANGERS?

For with S K F Ball Bearing Hangers the shaft rides almost frictionless, not only when well aligned but also under extreme conditions of misalignment. The inner race tilts with the shaft—the bearing can never bind.

The economy of this feature of S K F Hangers is better appreciated when it is understood that in the average plant using line shafting for power transmission, friction destroys at least 25 per cent. of all the power produced or bought.

Other most important features of S K F Hangers are ***longer life, lower maintenance cost,*** and a material saving in lubrication.

Canadian SKF Company, Limited

Montreal Toronto

SKF INDUSTRIES

Hess-Bright Ball Bearings
S K F Ball Bearings
Atlas Steel Balls
Gronkvist Chucks
Transmission Hangers

A Service that contemplates more than the sale of a bearing

Every S K F Industries service-salesman is a plant engineer equipped to consult on your power transmission problems. S K F Service made available through these men is built on a laboratory-backed ideal that seeks to increase Canadian output by lifting the friction load from industrial machinery.

Manufacturers are invited to avail themselves of this freely offered co-operation.



The S K F Research Laboratory where friction problems are solved

PETRIE

More than 130,000 Square Feet of Floor Space



The House of Good SERVICE

Quick service, an immense stock of Machinery and Supplies of all kinds, and the policy of doing business on a fair and square basis, has made the "House of Petrie" outstanding for DEPENDABILITY throughout Canada. For Machine Tools, for Supplies, for Service—go to PETRIE!

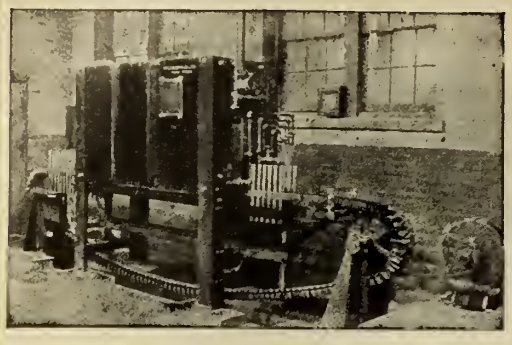
H. W. Petrie, Limited
Toronto and Hamilton

LATHES
PLANERS
SHAPERS
DRILLS
PUNCHES
SHEARS
HAMMERS

Everything in Machinery and Supplies

MACHINERY AND SUPPLIES

If interested tear out this page and place with letters to be answered.



Automatic Tube Annealing Furnace.

An example of "Quantity Production of Quality Product" made possible by use of Automatic Furnace.

AUTOMATIC FURNACES

Will they help ME?

That depends on the kind and quantity of material you handle per day, the regularity of its flow, layout of plant and machinery, fuel available, etc.

Having designed and built hundreds of Automatic Furnaces for many industrial heating requirements, we can help you determine whether the automatic furnace and continuous method of heat-treating would improve your product and lower its cost.

Many interesting applications of the continuous method to the field of industrial heating are shown in Bulletin 217-T. This bulletin illustrates and describes both the furnaces and the heating and handling methods employed in a great variety of manufacturing operations.

Write for copy of Bulletin to

Canadian Representative

R. J. McLEAN, 604 SOUTHAM BLDG., MONTREAL, P.Q.

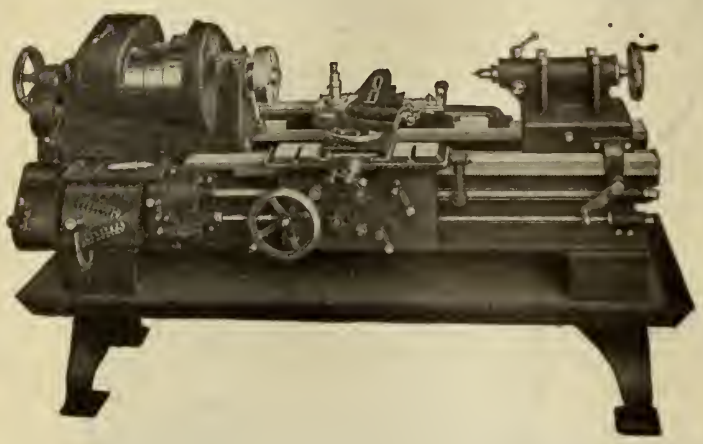
We Make Industrial Heating Furnaces for Every Requirement.

"Furnace and Fuel to Suit Conditions"

W. S. ROCKWELL CO. INDUSTRIAL FURNACES ESTABLISHED 1888 50 CHURCH ST. NEW YORK

"LEHMANN LATHES"

Will Put the Same Degree of Efficiency Into *Your* Shops as They Have in Many Others



TWO SIZES—16", Swing 18¼" and 18", Swing 20¼"

Because they are constructed "right" of the best material, workmanship and design, and therefore are adaptable to all conditions, whether it be work requiring accuracy to the highest standards or for the heavy duty where power, strength and rigidity are required.

Convince yourself of these facts! Let us send you complete specifications of this superior lathe and the names of some of the larger concerns who are using "LEHMANN LATHES" for better results.

We know you are interested, so don't put off writing us. Do it to-day. Now!

LEHMANN MACHINE COMPANY, 612 S. BROADWAY, ST. LOUIS, U. S. A.

Simonds Simonds

Hack Saw Blades That Reduce Cutting Cost

SIMONDS

For Machine or Hand Use. Hardness in the teeth for rapid cutting—Flexibility in the blade for long wear. They do not break when properly used.

SIMONDS CANADA SAW COMPANY, LIMITED

St. John, N.B. Montreal, Que. Vancouver, B.C.

Simonds Simonds

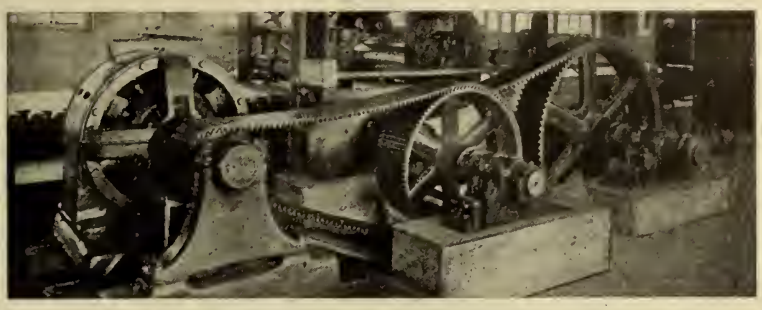
THE MORSE CHAIN CO.

are the
Largest Manufacturers in the world
of
High Speed Silent Chains

Why?

Morse Chain possesses the exclusive
Rocker Joint
Frictionless—Requires no Oilbath.

Jones & Glassco (Reg'd.)
Canadian Agents
Montreal - - Toronto



80 H.P. Morse Drive to Rolls, reverses direction every 45 seconds

Open a Bank Account in Canada

The present abnormal exchange situation between Canada and the United States is affecting trade relations between the two countries. Exporters in the United States can meet this by opening Bank Accounts in Canada.

This Bank has 700 Branches, of which 600 are located in Canada from the Atlantic to the Pacific Coast. Write for a complete list of Branches and for terms respecting a Canadian Account.

THE ROYAL BANK OF CANADA

Capital and Reserves $38,000,000 **Total Resources $589,000,000**

Head Office: MONTREAL

ELECTRIC

ALLOY STEEL GRAY IRON

STEEL AND IRON

High grade steel castings of every description. Send us your drawings for estimates.

Our motto is quality and quick service.

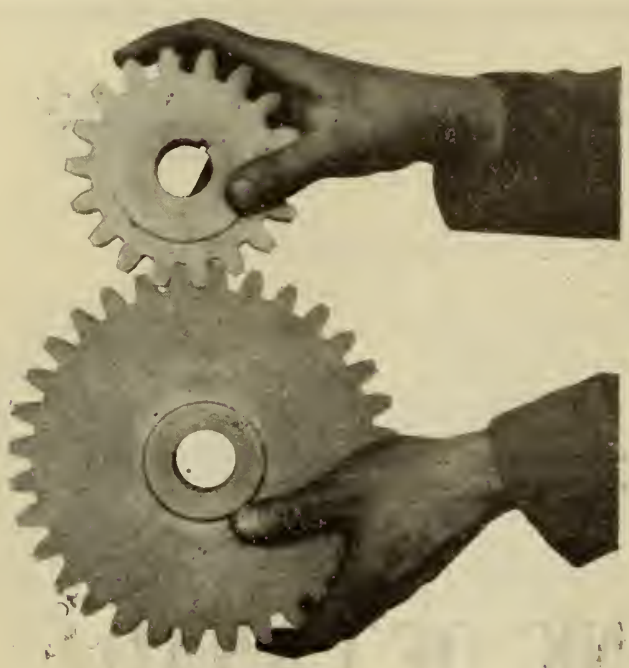
CASTINGS

Canada Electric Castings Co., Limited, Orillia, Ontario

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Cut Gears



Where Quality Counts

Hamilton Gear & Machine Co.

Van Horne St. - - TORONTO

BRIGGS MILLERS

Production Tools

Machine tools to-day are judged by their ability to do efficient work, save time, labor and expense. These have ever been the measures by which Briggs Millers have been designed and constructed. That our engineers have succeeded in meeting these requirements is evidenced by the increasing popularity of Briggs Millers.

No matter what the nature of the work or how severe the service the Briggs Miller will stand up to it. Its unusual rigidity, great strength and ability to take wide deep cuts when running at a high rate of speed, has established a wide reputation that is unexcelled. We would like to show how "B r i g g s" adaptability and convenience can increase output and lower costs for you. A letter will bring full details by return mail.



Gooley & Edlund, Inc.

CORTLAND, N.Y.

Canadian Representative:
Garlock-Walker Machinery Company, Ltd., Toronto

—for a large variety of grinding

if your variety of grinding is large invest in a Manhattan Universal Grinder. It is capable of handling cylindrical or internal grinding with the utmost in speed and accuracy.



Write for details.

Manhattan Machine & Tool Works

Grand Rapids, Mich., U.S.A.

Manhattan All-Around UNIVERSAL TOOL GRINDER

Foreign Representatives The Oliver Machinery Co., Ltd., Manchester, Eng. Farmer & Co., Clerkenwell, London, E.C.

2



WATTS'

ANGULAR HOLE DRILLING TOOLS

Can Be Used On Any Drill Press or Lathe

The drilling of square, hexagon and other angular holes has been attempted in the past—but with little success. Equipment, the cost of installation and upkeep would, in many instances, offset the saving of time.

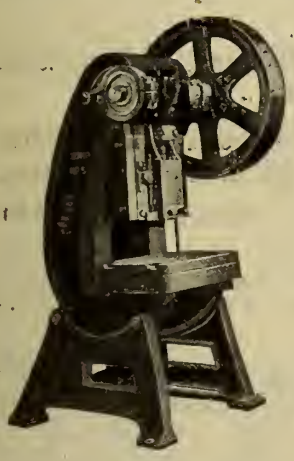
Watts' Angular Hole Drilling Tools require no special machinery as a drill press or lathe is to be found in any machine shop.

Have you angular holes to be drilled in steel, iron, brass, aluminum, micarta, bakelite, wood or marble? If so write and learn just how Watts' Angular Hole Drilling Tools will save you money.

The McClean Machine & Tool Co., Ltd.
125 Mary Street Hamilton, Canada

The "TOLEDO"

Inclinable Power Presses



The well-proportioned sturdy construction, combined with the exclusive "Toledo" features, assure 100% performance.

They are unsurpassed as general utility presses, being adapted to blank cutting, forming, perforating, drawing, shaping and combination die work.

Built in 20 sizes—Known and universally accepted as the Standard for half a century

The Toledo Machine & Tool Co.
Toledo, Ohio

THERE is as much difference in the various makes of High Speed Steel as there is in men—

The practice and methods of manufacturers differ widely in every mill and anyone who is at all familiar with the manufacture of High Speed Steel thoroughly understands this

"Red Cut Superior"

The Nationally Known—First Quality

HIGH SPEED STEEL

is the best for all Machine Work

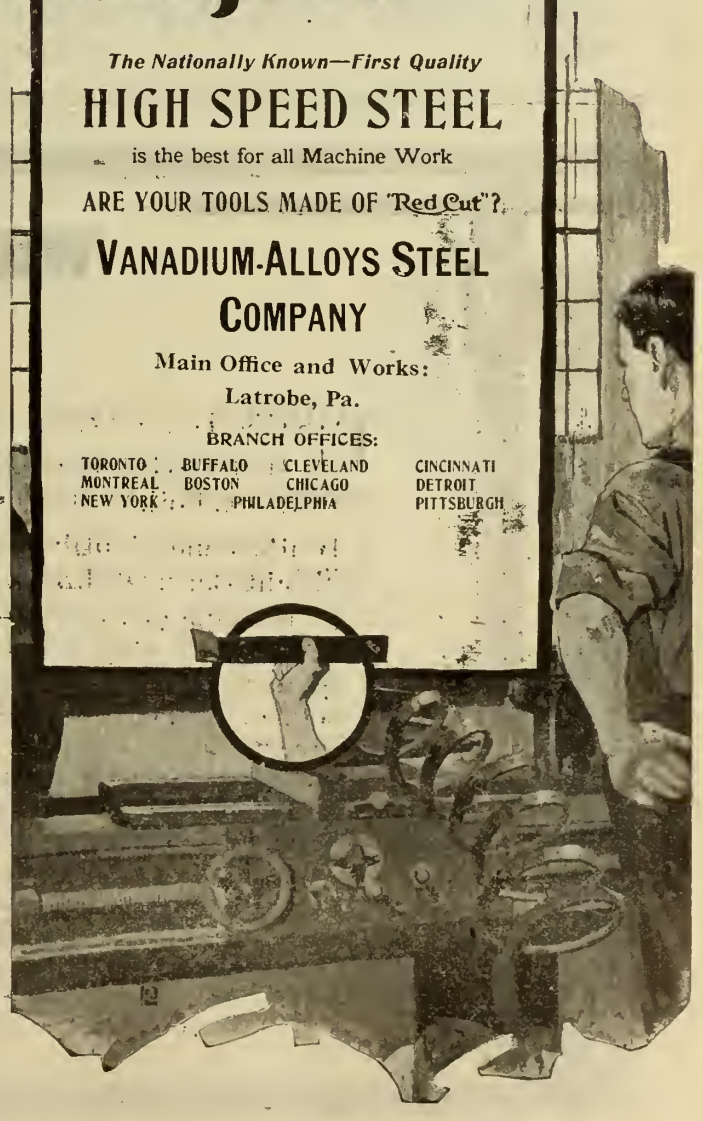
ARE YOUR TOOLS MADE OF "Red Cut"?

VANADIUM-ALLOYS STEEL COMPANY

Main Office and Works:
Latrobe, Pa.

BRANCH OFFICES:

TORONTO	BUFFALO	CLEVELAND	CINCINNATI
MONTREAL	BOSTON	CHICAGO	DETROIT
NEW YORK	PHILADELPHIA		PITTSBURGH



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A Group of Die Castings

showing some of the Possibilities of this Method of Production



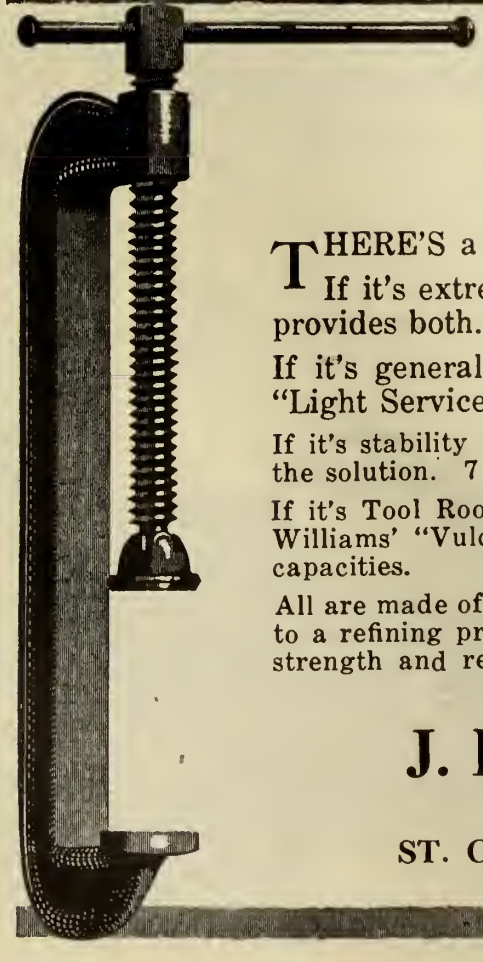
The automatic manufacturers of Canada have recognized the great saving in expense that results from having parts die-cast. No machining is necessary. Where parts are required in quantities this is the best-paying method of production—else the automobile manufacturers would not have adopted it. The parts shown above are die-cast automobile parts, giving some idea of the variety shapes possible.

Largest Makers of Die-Casting in Canada

Die-Casting Chat No. 28.—You may be in doubt whether or not you have a manufacturing proposition which could be treated by the die-casting process. Now in that case you are urged to put the question up to our advisory staff. They will help you solve it satisfactorily.

THE FISHER MOTOR CO., LIMITED

ORILLIA, ONTARIO



WILLIAMS' SUPERIOR DROP-FORGED CLAMPS

THERE'S a Williams Clamp for every purpose.

If it's extreme strength and heavy service—Williams' "Vulcan" line provides both. 11 sizes, ¾ to 12½ inches capacities.

If it's general utility—without need for maximum strength—Williams' "Light Service" line will fit the case, 8 sizes, 2 to 12 inches capacities.

If it's stability and utility—medium service—Williams' "Agrippa" line offers the solution. 7 sizes, 4 to 18 inches capacities.

If it's Tool Room work requiring comparatively small openings of jaws — Williams' "Vulcan" Tool Makers' line should be chosen. 4 sizes, 1 to 4 inches capacities.

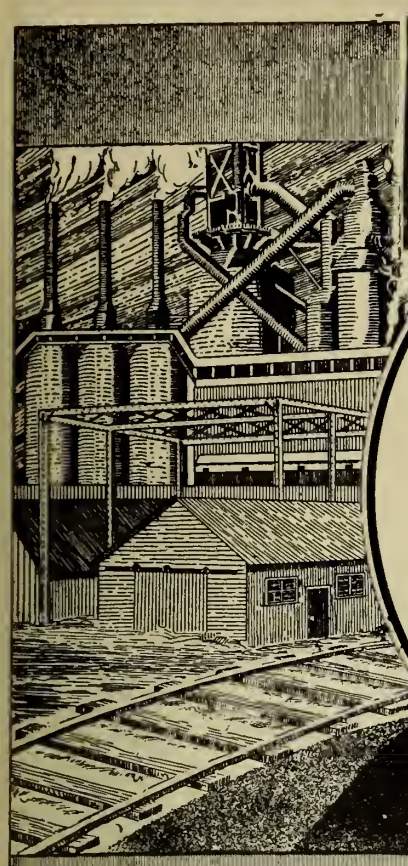
All are made of a special, high-grade steel. After forging they are submitted to a refining process, or "heat treatment," which increases their stiffness and strength and reduces the liability of springing.

MACHINISTS' TOOLS BOOK ON REQUEST

J. H. Williams & Co., Ltd.

"The Drop-Forging People"

ST. CATHARINES : : ONTARIO



SaBeN ExTrA HIGH SPEED STEEL

The Highest Achievement of British Tool Steel Metallurgy.

H. A. DRURY COMPANY LIMITED STEEL

MONTREAL TORONTO NEW YORK

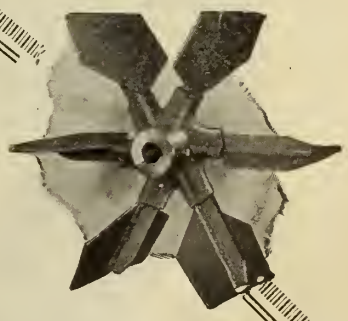
Agents for British Columbia:
Gordon & Belyea, Ltd., Vancouver

SABEN



3

Keep Your Shop Clean



Remove your sawdust, shavings, or other loose material with a

Canadian Standard Reversible Mill Exhauster



A clean shop with machines free from shavings, chips, or sawdust makes for greater efficiency.

Let our engineering department help you plan your refuse exhauster system.

Write for Catalogue 16

Canadian Blower and Forge Co., Limited
KITCHENER, ONT.

Toronto Montreal Calgary Vancouver St. John

If interested tear out this page and place with letters to be answered.



Using hack saw blades right is a man's size job. Takes experience—a lot of it.

"Hack Saws and Their Use" is a book based upon experience. We've been making blades for years, so we know something about hack saw steel, the pitch, shape, and set of the teeth, tempering, etc. We've put that into the book.



Then we've had a lot of experience using blades. We've tried different cutting speeds and pressures, made them cut all sorts and shapes of materials, with and without lubricants, timed the cuts, figured how much each cut cost. And what we've learned from that has gone into the book.

Every one of its 64 pages contains something worth while about hack saws. If you want to know how your cutting costs may be lowered write for "Hack Saws and Their Use." It's sent free to hack saw users. Address Dept. "3."

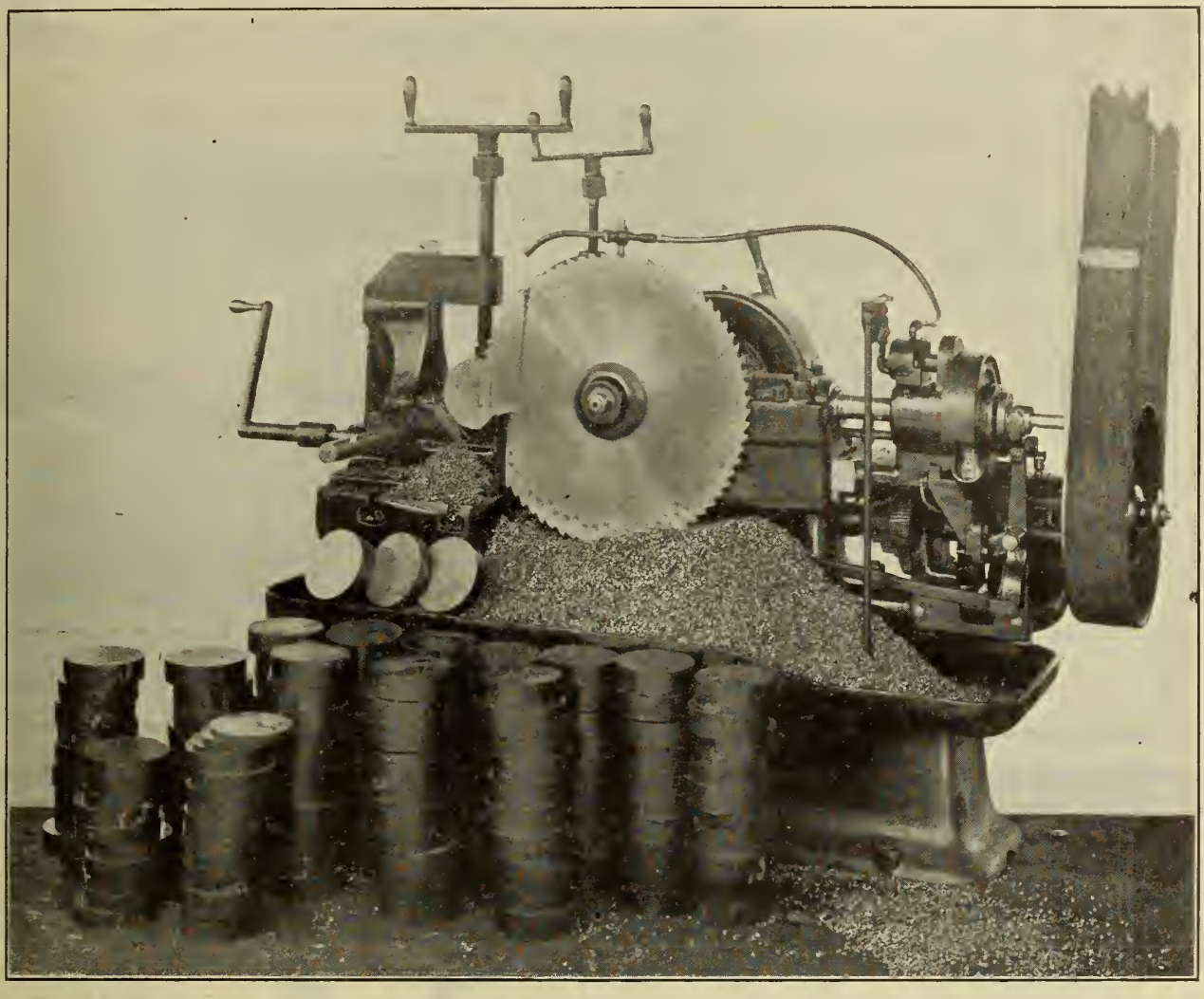
THE L. S. STARRETT COMPANY

The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.

12-100

Use Starrett Blades

COCHRANE-BLY No. 5 COLD SAW



144 Pieces 5¼" Diameter Cut on This Machine in 8 hours Actual Cutting Time was 3 Minutes and 10 Seconds Per Cut

Will Also Cut in Multiple at One Time

76 Bars ½ in. Diameter — **13 Bars 1½ in. Diameter**
26 Bars 1 in. Diameter — **8 Bars 2 in. Diameter**
4 Bars 2½ in. Diameter

We build five sizes of these machines, and also an Automatic Saw Sharpening Machine.

Catalogue on request

COCHRANE-BLY COMPANY

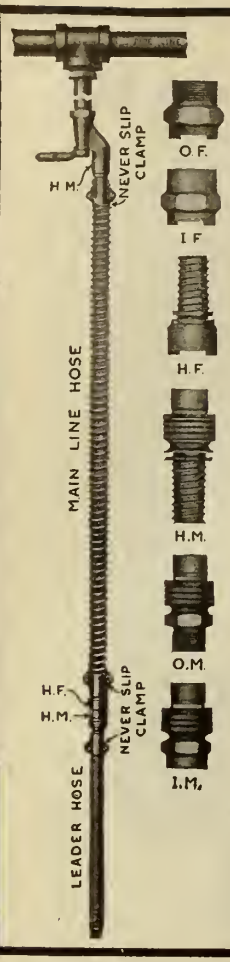
ROCHESTER, N.Y.

Agents for Canada:

A. R. Williams Machinery Co., Limited

Toronto Montreal Winnipeg Vancouver

If interested tear out this page and place with letters to be answered.



CLEVELAND HOSE SPECIALTIES

Bowes Automatic Air Hose Couplings

Standard Equipment Everywhere

STYLE O.F. is an Outside Thread Female Pipe End. Made in sizes ⅜-inch to 1½-inch.
STYLE I.F. is an inside Thread Female Pipe End. Made in sizes ¼-inch to 1½-inch.
STYLE H.F. is a Female Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼-in. to 1½-in.
STYLE H.M. is a Male Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼-in. to 1½-in.
STYLE O.M. is an Inside Thread Male Pipe End Made in sizes ¼-in. to 1½-in.
STYLE I.M. is an Inside Thread Male Pipe End. Made in sizes ⅜-in. to 1½-in.
The Male and Female Ends of Bowes Couplings interchange in sizes ¼-in. to ⅜-in. Sizes 1-in. and 1¼-in. interchange. The 1½-in. ends interchange only with themselves.

BOWES COUPLINGS

Are instantly connected or disconnected.
They are absolutely air-tight under all pressures.
They quickly pay for themselves by stopping costly leaks.
They interchange in sizes most commonly used.
They have no loose parts to be mislaid or lost.
They are made of brass and will not rust.
The U-shaped Gasket interchanges in couplings ¼-inch to ⅜-in.

The Cleco Never Slip Hose Clamp

Made in same sizes as Bowes Couplings

The adjoining cut of Cleco Never Slip Hose Clamp shows the "Flanges" which engage the groove provided in all hose ends of Bowes Couplings. The "Model Hose Line" illustrated shows correct styles of couplings and valve to use and proper way to attach the clamps.



CLECO GROOVED HOSE NIPPLE



Grooved Nipples when attached to hose with the wire clamp cannot "blow-out," as one-half of the Wire Clamp lies in Nipple Groove, and the other half on the hose, uniting nipple and hose permanently.

WIRE CLAMP TOOL

To apply Wire Clamps to Grooved Hose Nipples you need the Wire Clamp Tool illustrated, a small hand-operated tool at moderate cost which we carry in stock for immediate delivery. In Stock: Riveting and Chipping Hammers, Four-piston Air Drills, Corner Drills, Emery Grinders, Sand Rammers, Holder Ons, etc.



Use Annealed Wire No. 14

Write for Bulletin 38 illustrating Cleco Hose Fittings, Couplings, Valves, etc.

IMPORTANT:—The Small Leaks in your "AIR LINE" mean serious loss in DOLLARS. Have you any idea of the amount of "Air" wasted in small leaks at your connections? Air Leakage through 1-16 in. opening equals 5.32 cu. ft. per minute at 80 lbs. It will pay you to install Bowes Couplings and stop costly leaks.

Write for Bulletin 34A, 41 and 43.

CLEVELAND PNEUMATIC TOOL CO. OF CANADA LTD., 84 Chestnut St., TORONTO

A. R. WILLIAMS MACHINERY CO., TORONTO, 337 Craig St., W., MONTREAL. WILLIAMS & WILSON, MONTREAL

STEEL *for*
Every Commercial Purpose

We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open-Hearth Steel on the Shortest Notice.

Nova Scotia Steel and Coal Co., Limited

Head Offices:
New Glasgow, N.S.

Sales Offices:
Western Room 14 Windsor Hotel
MONTREAL



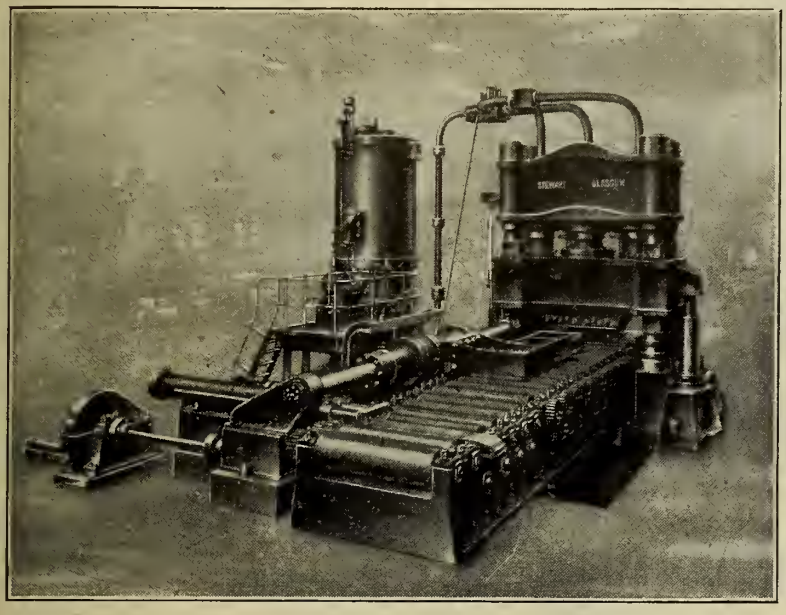
Steel Ingots
by the
HARMET
Liquid Process

DUNCAN STEWART & CO., LTD.

LONDON ROAD IRON WORKS: GLASGOW

Telegrams: STEWART, GLASGOW

Established 1864



Set of 54 in. x 16 in. Steam Hydraulic Slab Shears

STEELWORKS PLANT and HYDRAULIC MACHINERY

ROLLING MILLS.

FORGING PRESSES.

BLOOM, SLAB, BILLET and PLATE SHEARS.

PUMPS.

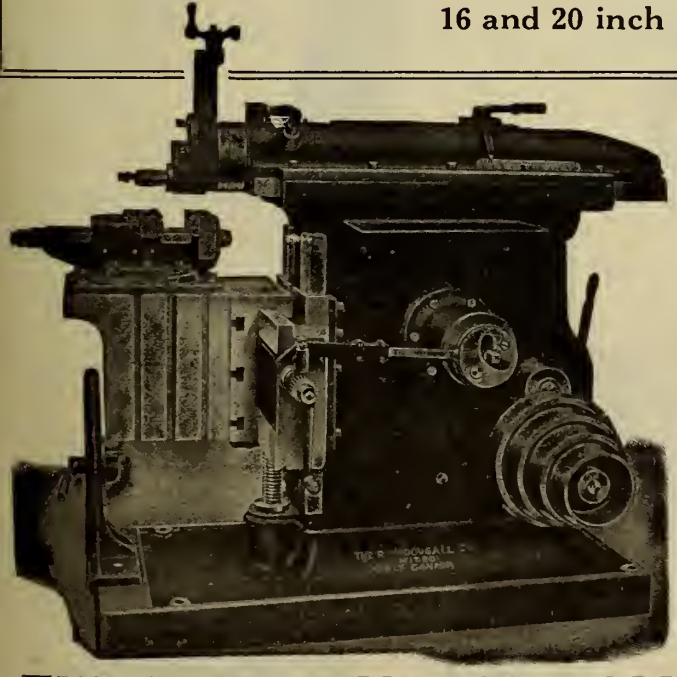
ACCUMULATORS.

HOT SAWS.

McDougall Crank Shapers

16 and 20 inch

ARE-MAC-DEE IS A GUARANTEE



A Bigger Day's Work—

is made possible with McDougall Crank Shapers than with any ordinary Shaper because the McDougall is built on lines especially for this purpose. It embodies the most approved features of the most practical shapers on the market and care has been taken to exclude all non-essential parts.

The column is massive in construction, well braced and reinforced internally. Exceptional strength is also seen in the ram, which is semi-circular in form and of box type. It can be set forward by crank conveniently arranged.

Slides are square, accurately fitted and with broad bearing surfaces.

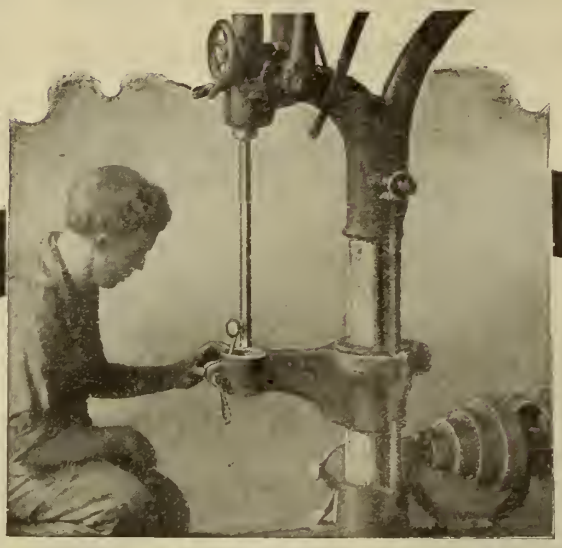
Have us explain the other salient points of this finely constructed machine. Full details on request.

THE R. McDOUGALL COMPANY, LIMITED, Galt, Ont., Can.

The Canadian Fairbanks-Morse Company, Limited
Sales Agents

If interested tear out this page and place with letters to be answered.

Three of the HOEFER Driller Vigilances *that insure accuracy*



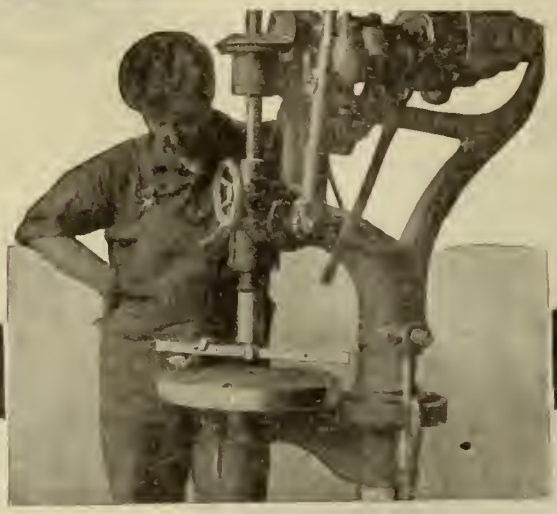
Accuracy Point No. 1

Here the operator is checking the trueness of the taper hole in the spindle. A long, hardened and accurately ground bar is inserted in the spindle, which is not passed if the variation at the end of the bar is greater than .0015".



Accuracy Point No. 2

In this test the operator is determining whether the stud of the table is true with the face. He does this by rotating the table on the table arm and will not O.K. if the variation is greater than .001".



Accuracy Point No. 3

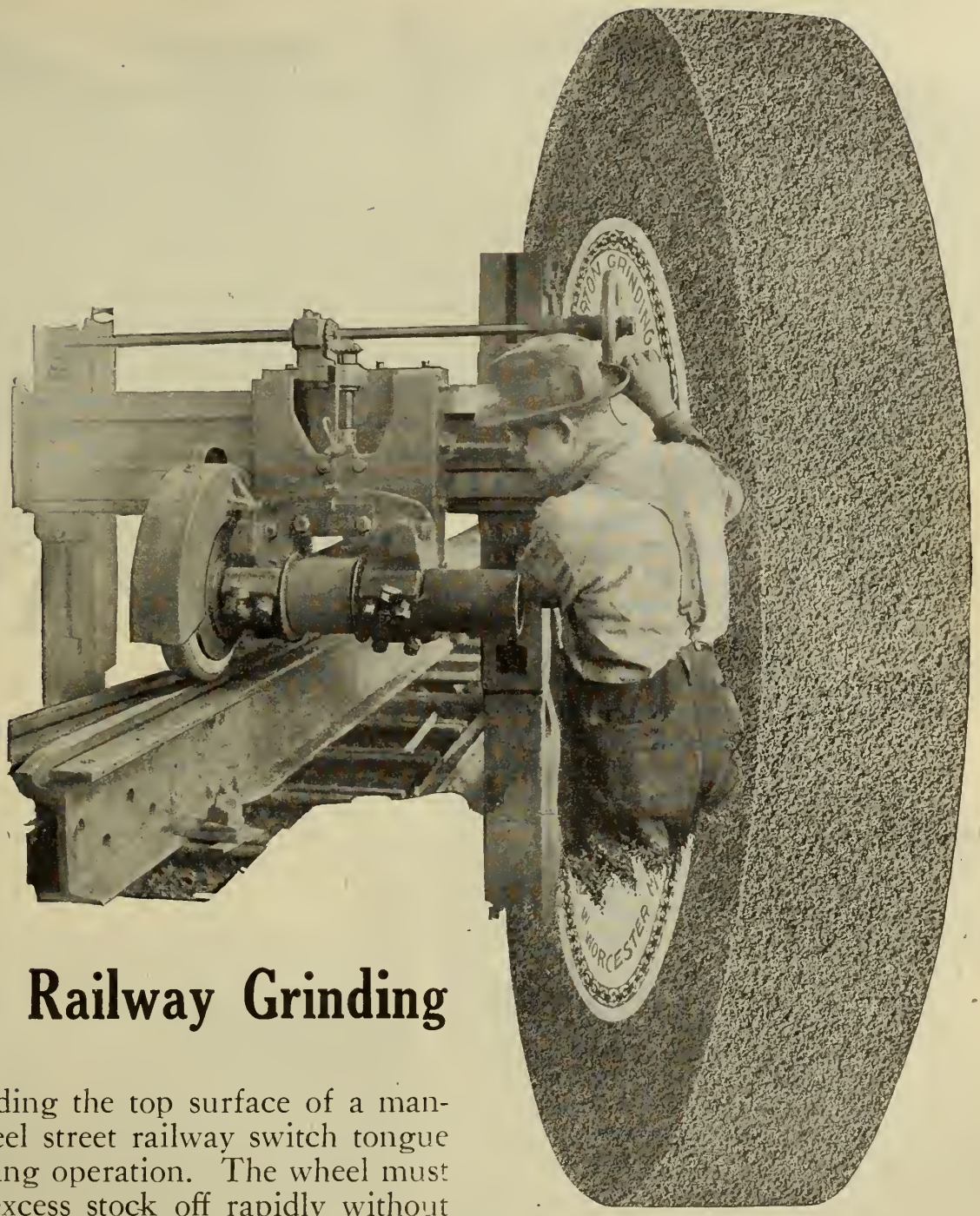
The operator here tests the perpendicularity of the spindle with the taper. In making this test the front edge of the table is indicated .0025" high in front in order to allow for wear and any possibility of springing.

Investigate the Hoefer Driller Send for Catalog

HŒFER MFG. CO. FREEPORT, ILL.

Sales Offices in principal cities

16A



Street Railway Grinding

Grinding the top surface of a manganese steel street railway switch tongue is a hogging operation. The wheel must tear the excess stock off rapidly without overheating.

A grain 6616, grade P, Alundum vitrified wheel does the job right.

Expert engineering service free to Norton grinding wheel users.

NORTON COMPANY OF CANADA, LTD.

HAMILTON, ONTARIO

Electric Furnace Plants

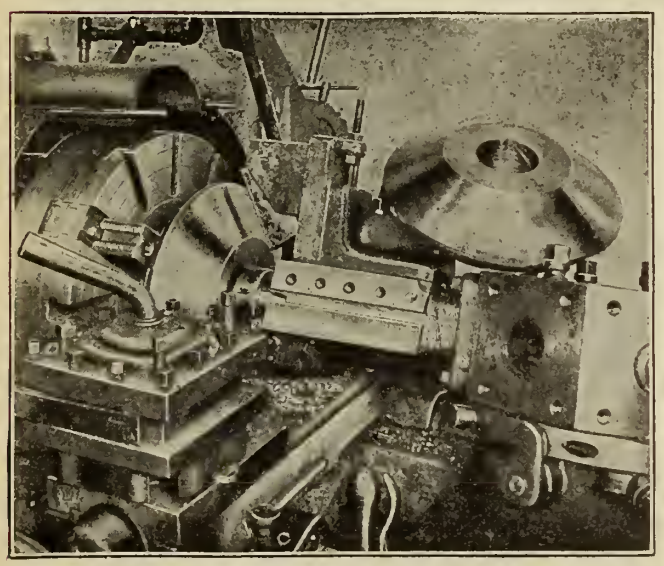
Niagara Falls, N.Y. **Chippawa, Ontario, Canada**

Canadian Agents: The Canadian Fairbanks-Morse Co., Ltd., Montreal, Toronto, Ottawa, St. John, N.B.; Winnipeg, Calgary, Saskatoon, Vancouver, Victoria. F. H. Andrews & Son, Quebec, Que. Simonds Canada Saw Co., Vancouver, B.C.

If interested tear out this page and place with letters to be answered.

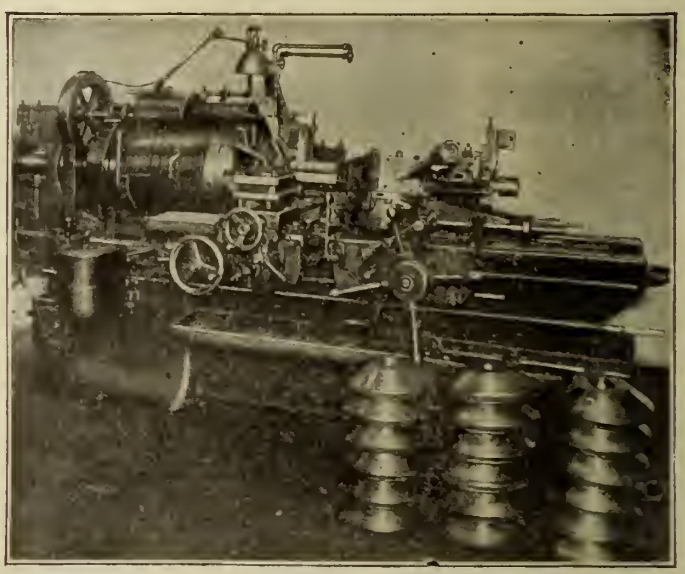


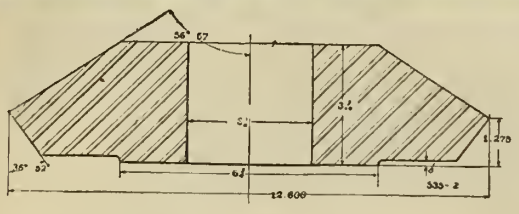
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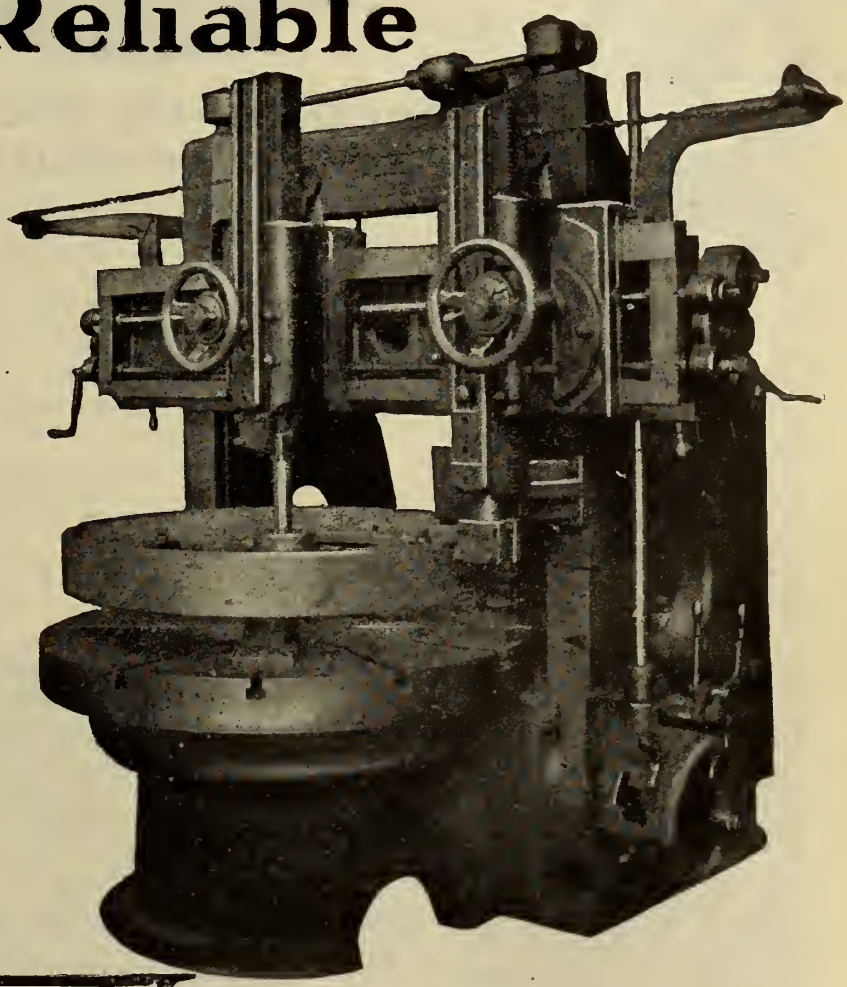
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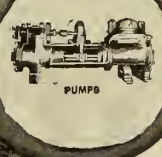
Foreign

Australia, Benson Bros., Sydney, Melbourne; Belgium, Ateliers Demoor, Brussels; Great Britain, Burton, Griffiths & Co., London, Birmingham, Manchester, and Glasgow, Scotland; France, Aux Forges de Vulcain, Paris; Italy, Emanuele Mascherpa, Milan; Japan, Andrews & George, Tokyo; Norway, Union Machine Co., Christiania; Sweden, Axel Ryden, Stockholm; Switzerland, J. Lambercier & Co., Geneva

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FAIRBANKS-MORSE




PUMPS

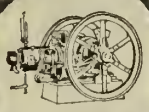

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XXIV. No. 15 October 7, 1920

Looking After a Big Family of Freight Cars

A Great Amount of System and Supervision Necessary to Avoid Endless Complications—How the C.P.R. Look After the Handling of Reports in the Car Record Office.

IN the early days of railroading, car records were not much in vogue for the reason that cars usually were confined to service on the rails of the owner. Shipments moving from one road to another were transferred at the junction point to cars of the receiving road. This condition obtained for many years, but with the expansion of industrial activities came through rates and through routes, and these aided by that all important factor—competition—gradually compelled all roads to permit their equipment to be loaded to points on other roads, with the understanding that the car and the contents would move through to destination without breaking bulk.

As cars commenced to move from one road to another, always subject to possible delays and diversions, it became necessary for car owners to keep a close tab on the movements of both home and foreign equipment. The same conditions made it necessary for the roads to get together and formulate rules and regulations to cover the interchange of equipment and to protect the accounting of car hire.

Prior to July 1, 1902, the mileage system of remuneration for the use of freight cars was in vogue, but on this date the Per Diem Rules became effective, and the latter are now in general use on all Canadian and American roads. Under the old system the owner of the car seldom received full return from the foreign roads for the use of the cars, but with Per Diem the road receiving a car must account for it to the car owner at the current per diem rate from the date of its receipt up to the date it is delivered to the owner or to another road, or in the case of a destroyed car, up to the date it is reported as a "destroyed" car to the owner, in accordance with the per diem rules.

Give all Information

Generally speaking, car records are maintained at all stations and contain everything there is to know in connection with the handling of the car contents, including the charges assessed or collected while in the terminal. Apart from the accounting features these records show the following information: Initials and number of car, kind of car, date and time of arrival, train reference, point of shipment and kind of commodity if a loaded car, date and time of notification to consignee of arrival of his shipment, date and time of placement, date and time of release, date and time car is forwarded, train reference, and, if car is loaded, kind of commodity and destination.

At stations where a great number of cars are handled there is also maintained a daily on-hand report, usually referred to as a yard check. This report shows the initials and number of the car, kind of car, on what track located and whether loaded or empty, and if held, for what purpose.

At stations where cars are interchanged with other roads, an interchange report is maintained which shows the initials and number of the car, kind of car, name of road to which car is delivered, date and time of interchange, name of billing station, name of destination station and kind of contents.

The movements of all cars on any part of the road and on foreign roads are re-

*Compiled by J. H. Rodgers, from Canadian Pacific Car Service office records, and the paper, "Car Records and Their Relation to Transportation and Car Accounting," read before the September meeting of the Canadian Railway Club, by J. D. Altimas, Asst. Gen. Supt. Car Service, C.P.R.



A GENERAL VIEW OF THE ACCOUNTING OFFICE. CAR SERVICE DEPARTMENT, C.P.R.

corded in the books of the Car Accountant, whose office is usually at headquarters. The basis of these records is the agents' interchange report, the conductors' freight or mixed train report and the foreign roads' junction report.

The interchange report now in use on all roads is authorized by the American Railroad Association and is known as the reciprocal form of report. The agent of the delivery road prepares the report in quadruplicate showing information for all cars delivered, and passes the completed report to the agent of the receiving road who checks the information shown thereon, and if he finds it correct, signs all four sheets, certifying to the receipt of the cars. He retains one copy of the report for his station record, sends one copy to his car accountant, and returns two copies to the agent of the delivering road. The latter keeps one copy for his station record and forwards one copy to his car accountant.

Under American Railroad Association rules where a railroad delivers a foreign car to a connection, not the owner of the car, he is obligated to advise the car owner the name of the road the car was delivered to and the date of the movement and to show whether the car was loaded or empty. This is called the junction report. Roads which use the cut up system preserve the interchange slips for foreign cars delivered and send them to the car owners as the junction report. This saves the delivering road considerable work and gives the car owner a first hand record, avoiding all errors due to transcribing.

The Interchange Report

Practically all of the larger roads now use the cut up or self transcribing system for conductors' train report and the agents' interchange report. Under this system the conductors' train report consists of one wide form giving all the information required, including an extra column for the date of the movement, also one narrow form, which is a duplicate of the wide form in so far as it refers to the initials and number of the car, number of station car is taken at and left at and date of movement. This narrow form has small holes punched in the margin between the lines to the left of the "initials" column for the use of the sorting clerks. These two forms are made at the one time by the use of carbon paper. In making entries on the narrow form it is not permitted to use ditto marks, as each slip, being separated from the rest, must show the complete information covering the car referred to.

The agents' interchange report consists of four wide forms giving all the information required, also two narrow forms which are duplicates of the wide forms in so far as they refer to the initials and numbers of the cars, name of road delivered by and name of road delivered to, name of station at which delivery is effected and date of delivery. The narrow forms have small holes between the lines to the left of the initials column for use of the sorting clerks. The narrow forms are of different colors—one pink for the use of the delivering road and one canary for the use of the receiving road. The pink indicates a delivered record, the canary a received record. The original and five copies of this report are made in one operation by the use of carbon paper. The information called for is shown on the section of the form, Fig. 2. For reasons before mentioned "ditto" marks must not be used on the narrow portion. These forms, when completed by the agents and conductors are forwarded promptly to the Car Accountant's office where they are entered into the car record books.

The handling of these reports in the car record office is a systematic and interesting operation. As soon as the mail is opened the reports are passed from the mail desk to the examining clerks who see that all information called for by the form is properly entered, after which the narrow forms are separated from the wide forms. The wide forms of the conductors' train reports

(25-2-18-2951)

CANADIAN PACIFIC RAILWAY COMPANY

CONDUCTOR'S REPORT OF FREIGHT OR MIXED TRAIN

Form 125

TRAIN No. 908 LEFT Outremont AT 6 00 M., 5/31 1920

ARRIVED Farnham AT 10 00 M., " 1920

	AA	AB	AC	AD	AE	AF	AG	For Statistical Purposes Only		AJ	AK	AL	AM	AN
	INITIALS	LOADED	EMPTY	KIND	DATE	TAKEN AT	LEFT AT			BILLING FROM	BILLING TO	CONTENTS KIND	CONTENTS TONS	TARE TONS
1	CABOOSE CP	430652			5/31	1406	1350							
2	INITIALS	LOADED	EMPTY	KIND	DATE	TAKEN AT	LEFT AT							
	"	389669		T	5/31	1406	1350			1410	300	OIL	40	40
3	INITIALS	LOADED	EMPTY	KIND	DATE	TAKEN AT	LEFT AT							
	WAB	24240		B	5/31	1406	1350			Dettaf	1320	Mx	30	19
4	INITIALS	LOADED	EMPTY	KIND	DATE	TAKEN AT	LEFT AT							
5	INITIALS	LOADED	EMPTY	KIND	DATE	TAKEN AT	LEFT AT							
30	INITIALS	LOADED	EMPTY	KIND	DATE	TAKEN AT	LEFT AT							
31	INITIALS	LOADED	EMPTY	KIND	DATE	TAKEN AT	LEFT AT							
32	INITIALS	LOADED	EMPTY	KIND	DATE	TAKEN AT	LEFT AT							
33	INITIALS	LOADED	EMPTY	KIND	DATE	TAKEN AT	LEFT AT							

ENGINE RECORD

A	B	C	D	E	F
Engine No.	FROM	TO	DOUBLING FROM	DOUBLING TO	Engines

RATING

G	H	I	K	L
Schedule Rating Tons	AUTHORIZED REDUCTION Class	Per Cent	Tons	Net Rating Tons

Tare or Equivalent

ENGINE NO | TRAIN | LIGHT | HELPING

Ton Mileage Contents

Tare or Equivalent

Certified correct, Agent at Departure Station

Certified correct, Agent at Arrival Station

Certified correct, Conductor.

	INITIALS	LOADED	EMPTY	KIND	DATE	TAKEN AT	LEFT AT
16	GTR	74260		F	6/10	1350	1406

	INITIALS	LOADED	EMPTY	KIND	DATE	TAKEN AT	LEFT AT
14	B & M		64207	B	5/27	1350	1406

	INITIALS	LOADED	EMPTY	KIND	DATE	TAKEN AT	LEFT AT
15	WAB	32008		B	4/30	1350	1406

FIG. 1—CONDUCTOR'S REPORT OF FREIGHT AND MIXED TRAIN. SPACE FOR RECORDING 33 CARS. LOWER PIECES SHOWS CUT UP SLIPS OF NARROW FORM.

are immediately turned over to the Statistical Department for their use, while the wide forms of the interchange reports are filed for ready reference. The narrow forms are then sorted and arranged according to the number of the car entries on the form. The forms are then piled into packages having about 200 or 300 in each package, the forms showing the smallest number of car entries being placed on top. This is done to enable the cutter to dispose of the blank slips as they come from the machine and thus eliminate the unnecessary handling of blank slips by the sorting clerks. Interchange reports are given preferred handling.

Working by Weight

When the narrow forms reach the cutter they are put through the machine, and as the slips leave the machine the cutter separates the blank slips from the record slips, throwing the blanks aside, and placing the record slips into small boxes enclosed on three sides only, these boxes having their tare weight (equivalent number of record slips) stencilled on them so as to facilitate the weighing. These tare weights are checked occasionally to see that there is no variation. The cutting is accomplished by a machine of the advance lever type and when the reports are of uniform size with spacing and holes also uniform there is little chance for mutilation of the slips. The reports are printed on paper of uniform weight and when cut up weigh approximately 272 per ounce. They are weighed after cutting into slips and also at the close of the day, so that each sorting and entry clerk is credited with the correct number of slips worked. An ordinary druggist's scale is used and gives every satisfaction.

Sorting the Slips

The sorting table is usually a high desk, with its top surface on an incline, and fitted with two rows of spindles one inch apart, one row being about seven inches behind the other. The spindles are 4 3-4 inches high with a shoulder or collar about 3-4 of an inch from the bottom. The part below the collar fits into holes bored in the top of the desk. One or more spindles are alloted for each record and sufficient spindles to accommodate all records are looked after by one sorting clerk. The spindles are a little less in diameter than the holes in the slips so that the sorters can slip them on the spindles very rapidly. Lists are prepared which show what records are alloted to each spindle, and these are located in a suitable position on the sorting table. When sorting the slips are held in the right hand and sorted with the left, otherwise the car initials would be covered and the handling would be much slower. Sorting clerks generally handle about 26 to 30 slips per minute. The original sorting is done to suit individual requirements. Usually the first sorting is done in book form and the second in page order. The latter is not always economical.

The junction records when received on the standard junction report form are transcribed by typewriter to the cut-up form and are passed through the machine in the same manner as other forms and are then passed on to the sorters. Junction records received on the cut-up forms are at once turned over to the sorters for handling. At regular periods during the day the record clerks obtain the slips from the sorting desk and proceed to enter them in the books. By this method a record clerk does not have to handle any records except those that are to be entered in his book. The record books are of the loose leaf type and usually about 18 inches long by 17 inches wide. The home car record sheets are ruled about as follows: See Fig. 3.

One column about one inch wide for car number, then 31 columns 3-8 of an inch wide for the days of the month and one column about one inch wide at the extreme right for mileage as per diem purposes. Each page holds fifty cars and a book usually includes 5,000 cars in numerical order. The home car record usually is made up to take care of two months' records in order to avoid the necessary transferring of the records from one book to another.

The foreign car record sheets are ruled as follows: See Fig. 4. One column about 3-4 of an inch wide for the last account, another of the same width for initials, another for the car number, 1-4 inch columns for, kind of car, per diem days earned, checking, for each day of the month, and three or four 3-8 of an inch wide for mileage purposes. Each page holds fifty cars and each book has space for about 6,000 cars of which from 1,500 to 1,800 are actually in service at any one time. These books are made up to show cars in alphabetical road order and in numerical order and are indexed for ready reference.

Watching Interchanges

When a clerk is ready to enter records he first finds the space alloted to the car and then enters in the block which represents the date of the movement, the number of the station at which the car was taken and the number of the station at which the car was left. Usually the number of the station at which the car is taken already appears in the block and it is only necessary to enter the number of the station at which the car is left and a check mark drawn after the number of the station at which the car is left indicates that the record is complete. When a car moves empty the pencil line drawn above the number of the station at which the car is left shows the record is complete.

In the case of interchange records, a receipt from the connecting road is entered by showing the symbol representing the road in the upper left hand cor-



THE PICTURE TO THE LEFT SHOWING THE FOUR SORTING CLERKS, ILLUSTRATES THE FIRST SORTING AFTER THE FORMS ARE CUT INTO SLIPS. TO THE RIGHT—SORTING THE SLIPS INTO PAGE ORDER.

ner of the book immediately followed by the number of the station. To indicate a delivery to a connecting road the symbol of the road is entered in the lower right hand corner of the block preceded by the station number. In practically all cases the number of the station appears in the record and it is only necessary to enter the symbol. Home record clerks average about 300 entries per hour, whereas foreign record clerks average about 225 entries per hour.

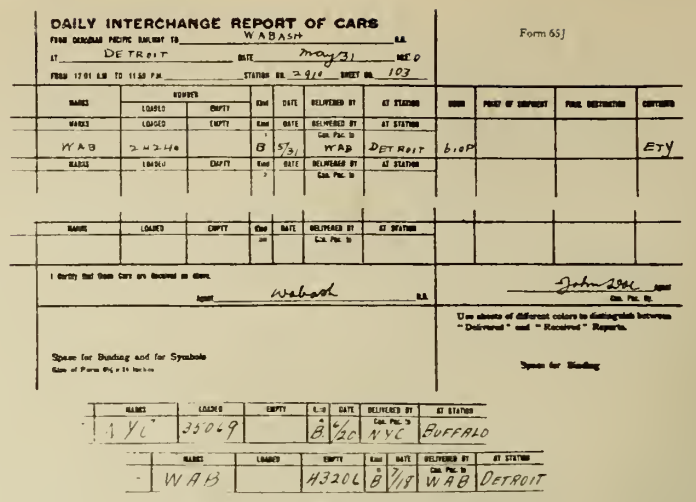
Roads which do not use the cut-up form of reports simply take the interchange reports, conductors' train reports and the junction reports from the mail desk, place them in suitable packages for handling and pass them around to the several record clerks who enter the movements direct from the reports to the books. Under this method each clerk must examine every car shown in the report in order to pick out the records which are to be entered in his book. This takes considerable time and labor.

With a record of every movement made by cars on his own rails, with the interchange record of cars delivered to and received from connections and with the junction record of his cars furnished by foreign roads, a car owner has a complete record of every one of his cars during each month of each year. This enables him to keep a close check on the handling of his cars by foreign roads and to check the earnings of his cars under any and all circumstances. He is also in a position to know what other owners' cars are doing on his rails.

Car records properly maintained and kept up-to-date are of great benefit and serve many purposes of the Transportation Department in addition to being the basis of the accounting for car hire. The following are some of the uses to which car records are constantly put:—

To furnish records to the public in connection with shipments in which they are interested.

To furnish records to the Transportation Department to assist in tracing freight urgently required at destination or which may have been unduly delayed in transit or which may be required to be diverted in transit.


DAILY INTERCHANGE REPORT OF CARS

FROM CANADIAN PACIFIC RAILWAY TO WABASH R.R.

AT DETROIT DATE May 31 19 0

FROM 12 01 A.M. TO 11.59 P.M. STATION NO. 2414 SHEET NO. 103

Form 65J

MARKS	BORROWED LOADED	BORROWED EMPTY	Kind	DATE	DELIVERED BY Can. Pac. Ry.	AT STATION	WHEN	POINT OF SHIPMENT	FINAL DESTINATION	CONTENTS
WAB	24148		B	5/31	WAB	DETROIT	6.10P			ETY

I certify that these Cars are received as above. Agent Wabash R.R.

Use sheets of different colors to distinguish between "Delivered" and "Received" Reports.

Space for Binding and for Symbols

Space for Binding

MARKS	LOADED	EMPTY	Kind	DATE	DELIVERED BY Can. Pac. Ry.	AT STATION
NYC	35049		B	6/20	NYC	BUFFALO
WAB		H3206	B	7/18	WAB	DETROIT

FIG. 2—AGENTS' INTERCHANGE REPORT. SPACE RECORD FOR 22 CARS. CUT UP SLIPS SHOWN AT BOTTOM.

To furnish location of special class equipment, such as refrigerator, tank, potato, Eastman heaters, palace horse, special grain cars, etc., to enable the Car Service Department to keep them in the special service to which they are allotted, or to move them to points where they are required, also to see that such cars are used to full advantage.

To furnish car movements, loaded and empty, to the Transportation Department to assist in tracing delays and placing responsibility and to the Claims Department to assist in locating overs and shorts and disposing of claims.

To check the handling of cars on foreign roads and thus overcome unnecessary delays and diversions.

To furnish weekly or monthly statements of the distribution of all classes of equipment by districts or divisions.

To furnish records of car loads transhipped in transit.

To furnish mileage, loaded and empty, made by special class cars or cars of any class.

To check the record of foreign equipment to see they are not unduly delayed or used contrary to Car Service Rules.

To check repair bills as to location.

A record clerk works on the average about six hours a day in entering records and about two hours a day in furnishing locations, movements and other information.

The car record is the basis of the car hire accounting system and the car records of foreign equipment handled are usually turned over to the Accounting Department about the tenth day following the close of the month. The first duty of the clerks on accounts is to ascertain what records are incomplete, i. e., what cars are short on interchange receipt or delivery and to check back against the interchange reports to see if such records were skipped by the record clerks. The second operation is to extend the number of days each car was on the rails, and where there is an incomplete record, to list the initials and the numbers of the cars so as to aid the correction staff. in completing the records.

Where a missing delivery is involved per diem is usually allowed up to the date the car is last reported moving. In the case of a missing receipt per diem is allowed from the date car first moved. When the record has been completed, the balance of the per diem, if any due, is allowed in a subsequent month's report.

After the per diem days have been extended, a per diem report is prepared for each road, showing the car number and the number of days earned and same is forwarded to the car owner, within forty days from the last day of the month in which the per diem was earned. On the receipt of the per diem report by the car owner he enters in the record opposite each car the number of days per diem allowed by each road, and after all the per diem reports have been carried, if his records indicate a shortage, he has the privilege of making claim against the road which, according to his records, has short-paid the per diem. Such claims to be valid must be handled in accordance with the rules.

In addition to preparing reports for per diem earned currently, reports are also prepared to cover errors and omissions in per diem reports of previous months, to cover switching reclaims, to cover rule 14 reclaims, namely, cars held by one road on account of inability

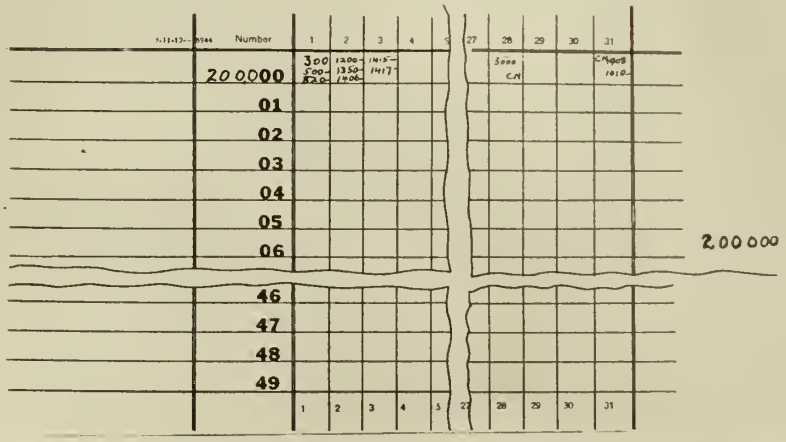
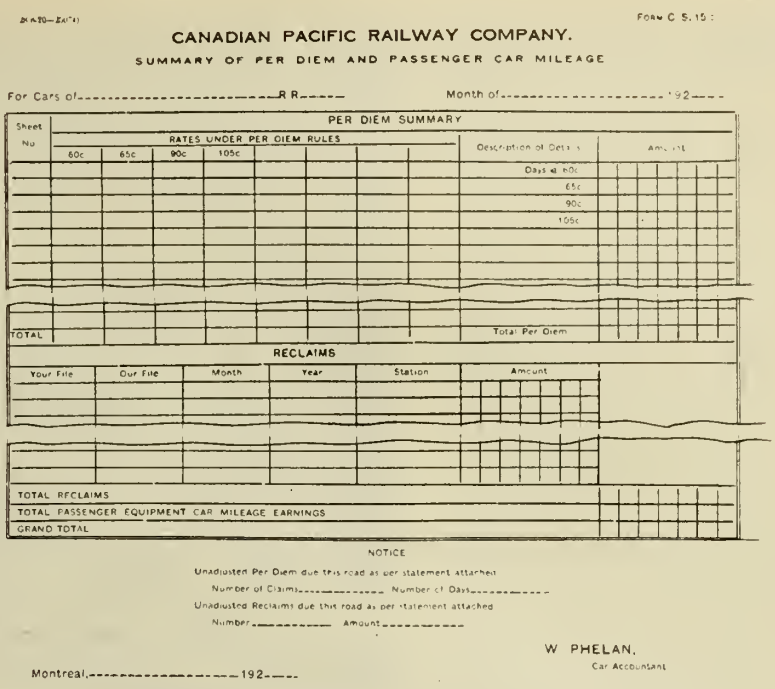


FIG. 3—HOME CAR RECORD SHEET. SPACE ON EITHER PAGE, OR SIDE OF THE SHEET, FOR TEN MONTHS' MOVEMENT OF ANY OR ALL CARS IN THE SERIES.

of another road to receive and to cover reclaims due to special conditions.

Under Per Diem Rules, per diem must be paid by a road using a car to the owner for each and every day car is in service on that road, but where a road handles a car in terminal switching service for another road it is entitled to an arbitrary reclaim from the carrier road of an agreed number of days not to exceed five for each car handled in such service. Per Diem Rule 15 also provides that where a road holds cars on account of another road to receive them, the holding road is entitled to reclaim from the road on whose account the cars were held the full amount of per diem involved, always provided that due notice is given in accordance with the rules.

The Per Diem Rule Agreement, to which practically all American and Canadian roads subscribe, is promulgated by the American Railroad Association and lays down rules to govern every phase of per diem accounting. These rules in their original form were adopted and made effective on July 1, 1902. Since that date there have been changes from time to time in the rate to take care of the increased cost of owning and operating a car. At the present time the rate is 90 cents per day. The main objection to the rules in their original form was that no penalty was provided for the non-payment of per diem earned


CANADIAN PACIFIC RAILWAY COMPANY.

SUMMARY OF PER DIEM AND PASSENGER CAR MILEAGE

Form C. S. 15

For Cars of ---------- R R ----- Month of ---------- 192---

PER DIEM SUMMARY

Sheet No

RATES UNDER PER DIEM RULES

60c 65c 90c 105c

Description of Debits

Amount

Days at 60c

65c

90c

105c

TOTAL

Total Per Diem

RECLAIMS

Your File | Our File | Month | Year | Station | Amount

TOTAL RECLAIMS

TOTAL PASSENGER EQUIPMENT CAR MILEAGE EARNINGS

GRAND TOTAL

NOTICE

Unadjusted Per Diem due this road as per statement attached

Number of Claims ---------- Number of Days ----------

Unadjusted Reclaims due this road as per statement attached

Number ---------- Amount ----------

W. PHELAN,
Car Accountant

Montreal, ---------- 192---

FIG. 6—SUMMARY OF PER DIEM AND PASSENGER CAR MILEAGE. SIZE OF SHEET 11x8.

While an improvement this ruling did not effect the end desired, and revised rules became effective on the 1st of March, 1920. The next few months will show how these new regulations will work out.

The Per Diem Rules have done more

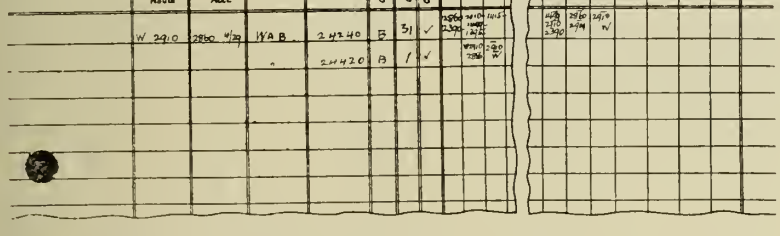
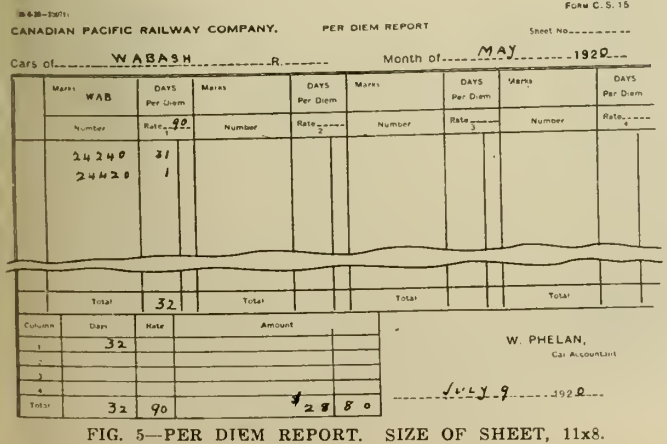


FIG. 4—FOREIGN CAR RECORD SHEET. SPACE EITHER SIDE FOR MONTH'S MOVEMENT OF FOREIGN CAR WHEN ON TRACKS OF C.P.R.

and as a result the car owner was put to considerable expense to collect what rightly belonged to him. On July 1, 1913, a penalty of 5 cents per car per day was made effective when per diem was not paid to the car owner within six months from the last day of the month in which the per diem was earned.

than anything else to force the railroads to keep proper car records. While it may be true that the cost of accounting for car hire under per diem rules is much greater than under the mileage plan, there is little question that the extra saving more than balances the additional cost. Under the per diem car system a car owner knows exactly what his cars earn and methods are provided for accurate accounting, whereas, under the mileage plan the car owner had no means whatever of checking the earnings of his equipment on foreign roads and had virtually to accept whatever was allowed. In the old mileage days many cases of deliberate dishonesty in accounting were developed and the conditions helped a great deal in the agitation that was carried on in favor of the adoption of the per diem system.

Car records to be of value must be properly maintained and kept up-to-date. This can only be accomplished by the hearty co-operation of all concerned in the preparation and handling of the reports and the records. In the Car Accountant's office surprise checks are used to a great extent and with good results to ascertain if the correct and complete information is being recorded in the books. With this system the clerks soon realize that they must do their work properly or make way for others who will. The secret of the whole transaction is system and supervision.


Form C. S. 15

CANADIAN PACIFIC RAILWAY COMPANY. PER DIEM REPORT

Sheet No ----------

Cars of WABASH R. ------ Month of MAY 1920

Marks WAB | DAYS Per Diem | Marks | DAYS Per Diem | Marks | DAYS Per Diem | Marks | DAYS Per Diem

Number | Rate 1 90 | Number | Rate 2 | Number | Rate 3 | Number | Rate 4

24240 31
24420 1

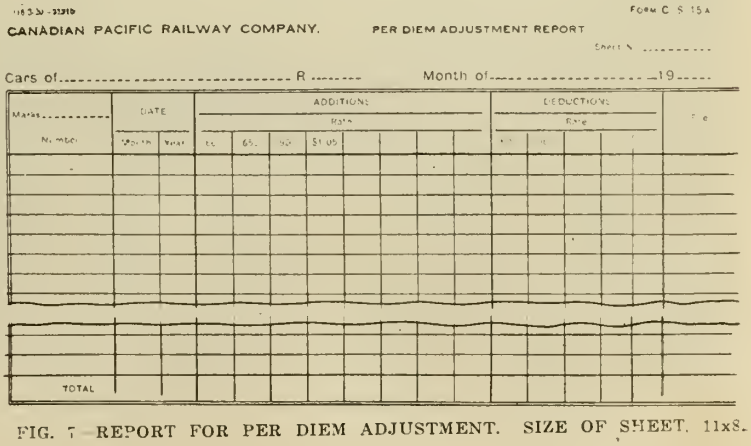
Total 32 | Total | Total | Total

Column	Days	Rate	Amount
1	32		
2			
3			
4			
Total	32	90	$28 80

W. PHELAN,
Car Accountant

July 9 1920

FIG. 5—PER DIEM REPORT. SIZE OF SHEET, 11x8.


Form C. S. 15A

CANADIAN PACIFIC RAILWAY COMPANY. PER DIEM ADJUSTMENT REPORT

Sheet No ----------

Cars of ---------- R ------ Month of ---------- 19---

Marks ---------- Number | DATE Month Year | ADDITIONS Rate 60c 65c 90c $1.05 | DEDUCTIONS Rate | File

TOTAL

FIG. 7—REPORT FOR PER DIEM ADJUSTMENT. SIZE OF SHEET. 11x8.

Nine Examples of Jig and Fixture Practice

Various Principles Are Discussed Such as the Snapper, Universal Chuck, Turnover and Slide Stop Motion. Each Jig Depicted Has Proved to Be the Best for Its Own Particular Work.

By J. H. MOORE

TAKING it for granted that everyone realizes the advantages of efficient jigs and fixtures, we will proceed to describe seven interesting examples of fixtures which have proved real producers for The International Harvester Co.. Hamilton, Canada.

The first of these depicted at Fig. 1 is what is known as a snapper jig. It is so-called because it snaps into place quickly and holds the work very firmly. Referring to the illustration we see that A is a solid cast iron base, while B shows one of three jaws very similar to those used on an ordinary lathe chuck. These jaws are adjustable and come in at the same rate of speed towards the centre, receiving their motion from the action of handle shown to right of the letter A. They, of course, slide in the Tee shaped slides C. This feature means that the work E, which is a portion of a manure spreader, is always centred before the top portion of jig comes down on it.

Having centred the work, the handle F is released which brings down the cup shaped brush D on top of the boss on the work E. The pin H acts as a guide, and underneath this pin at each side of jig is fastened a strong spring. The action is apparent. The spring pulls the top down with considerable pressure, the lever G being part of the movement. This type of jig is widely used at the plant we speak of and can handle a large variety and range of work. The operation in this particular case is the drilling of a 1 1-4-in. hole through the centre of the work E. The casting as shown is approximately 16-in. diameter, but the jaws of jig can come in to take a much smaller piece if necessary.



FIG. 2—THIS STYLE OF JIG PROVES THAT IMPROVEMENT IS ALWAYS POSSIBLE.

An Improved Type

The jig as described at Fig. 1 was the original snapper type, and hundreds of the same have been made with splendid success. There is a saying that no matter how good a thing is, it can always be improved upon, and this holds good in the present case as Fig. 2 will illustrate.

The fixtures shown in this view are really improved offshoots of the snapper jig, but are termed the universal chuck type, owing to their having an ordinary universal chuck as the holding unit.

It will be noted that a universal chuck is placed directly in the centre of the jig base, and that two bosses are placed on each side of the aforementioned base. In these bosses are fastened two guide pins. The swinging member A has a cup shaped bush in the centre boss C. The quick action clamp D grips the other guide rod, and by referring to E you can see the clamp released. In action you loosen a purled knot a quarter turn which brings the clamp to the position shown at E allowing you to swing the top members of jig out of the way. B illustrates the work in one case, and the other view shows a still different type of gear being drilled.

The great advantage of this type of jig over the one depicted at Fig. 1 is the fact that by changing the bushings at C to suit the nature of the work, you can use the fixture for an almost endless variety. Of course it is only adapted to parts of round shape, parts which can be gripped in the chuck. Since installing the improved design, the former shown at Fig. 1 have taken a back seat, although for certain classes of work they are still ideal.

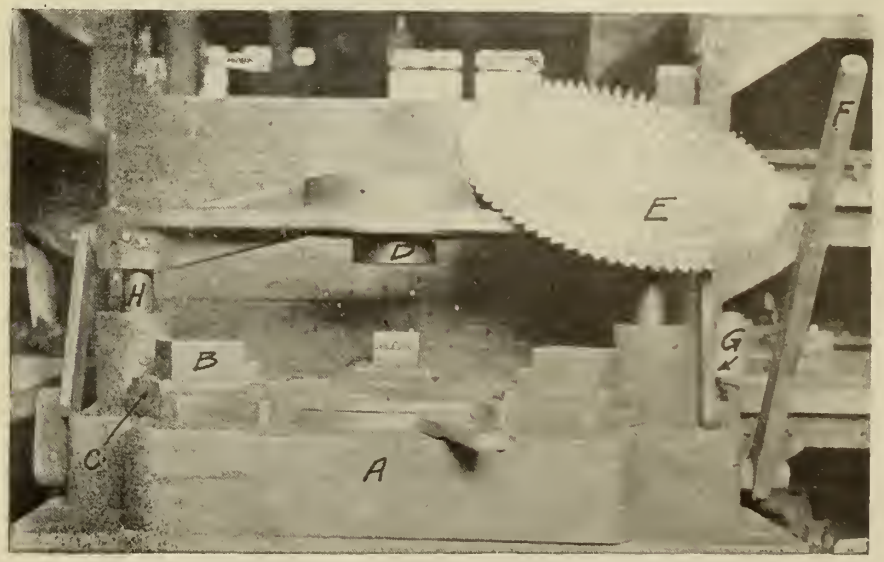


FIG. 1—THIS STYLE JIG IS KNOWN AS A SNAPPER JIG.

Reaming Jigs

The next two examples are shown at Fig. 3. Both jigs are used on the same piece, and we will take them up in order starting with the one shown to the left. The work being performed is that of reaming from the cored hole a 2 3-8-in. hole. Note the action of the clamp A. On inserting the piece in the jig, the shaper wedge B is driven in, this in turn raising the back end of clamp A, and pressing the point of the same down firmly on to the work. The swivel screw C is next brought into action, this guaranteeing that the work goes up into correct position.

To the right is shown the reaming of

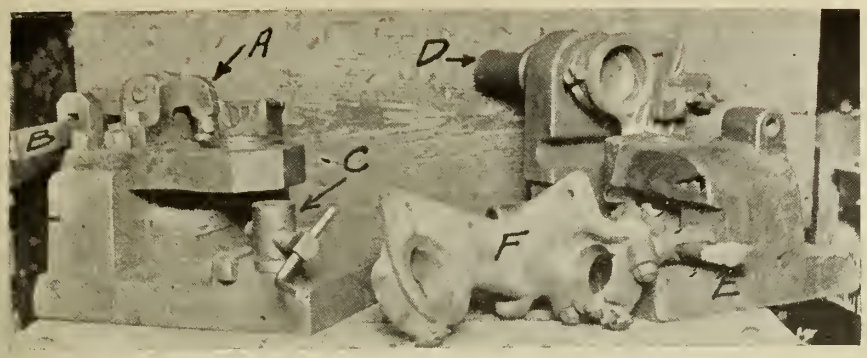


FIG. 3—TWO EXAMPLES OF REAMING JIGS. NOTE THE METHODS OF HOLDING.

the second hole, 1 5-8 in. diameter. The work is gauged from the former hole reamed by means of the pin D, and is held in position by both the small screw shown at top of jig, and the taper wedge E. The view at F. illustrates clearly the details of the piece for which these jigs were made.

Turnover Jigs

Fig. 4 illustrates two other jigs known by the term turnover jigs. The fixture to the left is used to drill two holes in the piece A at the points shown by cross marks in chalk. The method of obtaining these two positions is very simple. Note the slot C at lower portion of the fixture. It is cut at the correct radius, and of sufficient length to allow the correct distance of travel. Two bushings, which are hidden from view by the work in the jig, guide the drills to their proper positions. In action the operator merely places the work on the circular shaped portion of jig, fastens it by the taper key B, drills one hole at one extremity of the slot, and one at the other. The pin which is inserted in the slot acts as a positive stop. This type fixture is easily made and is very efficient.

The second jig, that to the right, is used to drill the tongue for a whiffletree shown at D. Note the two chalk cross marks. This denotes where the holes are drilled. There are four holes drilled, two on either side of the casting.

The method of procedure is as follows: The work is placed in position and held by the taper key shown. The two holes are drilled on one side of the casting, then the moveable portion of the jig is pulled out of a slot in the stationary member, and revolved 180 degrees, then pushed back into locking position once more. The collar F prevents the moveable portion being pulled out too far. The remaining two holes are now drilled, and of course they cannot be anything else than opposite the other two, owing to the safe method of locating.

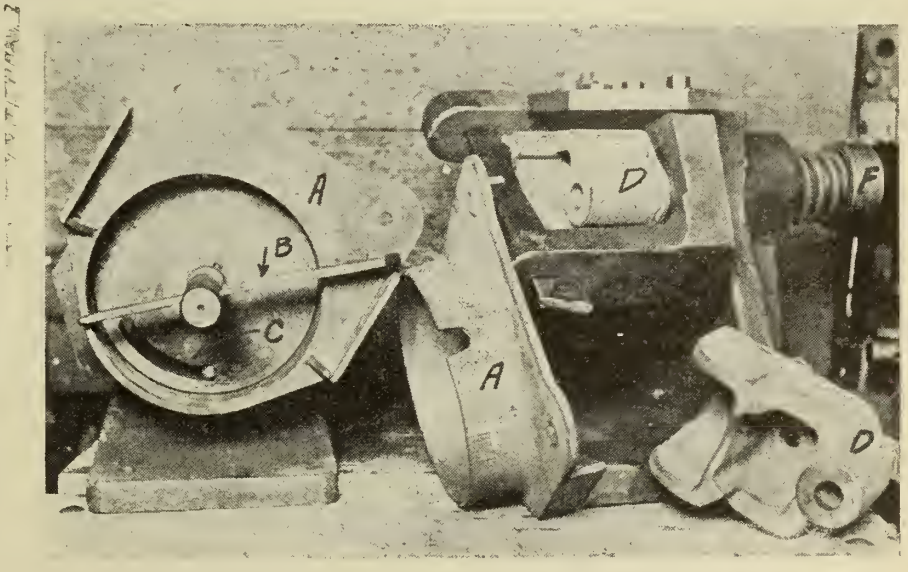


FIG. 4—TWO JIGS THAT EMPLOY THE TURNOVER PRINCIPLE

This turnover principle is used to great advantage in the plant we speak of, hundreds of various style turnover fixtures being used.

Three Varied Jigs

The last photo, Fig. 5, illustrates three distinct types of jigs. Starting from the left we find as follows: The fixture to the left is used to drill the two top holes on the part A which is a portion of a fertilizer. These holes are on a radius, and here is how they are drilled. The work is placed on the moveable portion B, over the centre rod, then fastened in position by means of the taper key shown. This portion B slides on a guide slot about 4-ins wide, and of the correct radius to accommodate the holes. Two bushings are placed in correct position at top of piece B. First one hole is drilled at extremity of slot partially shown in stationary member, then the other is drilled at opposite position. To allow for adjustment, an adjustable screw with lock nut is placed at either end of the radius shaped slot, and any adjustment necessary can be accomplished very easily.

The jig shown at the centre is simply a pin jig to drill the pin D as shown, but the ejector used is worthy of note. The work is placed in Vee block E and drilled through a bushing in the regular manner. On being completed, the operator merely touches with the palm of his hand the collar at end of F and the spring accomplishes the rest. It shoots the pin out of the jig, and of course springs back into gauging position as soon as the hand leaves the collar F. The output on this particular piece has greatly increased since installing this style of ejector

The last fixture to be discussed is used to drill the four holes in piece G. Four bushings H are placed in correct location and work fits into jig up against stop pin shown, and held in position by screw with handle.

This portion of the jig moves in a radius similar to fixture shown on the left, but in a horizontal position. A radius shaped slot in the base of jig limits the travel.

From the foregoing examples of jig practice readers will no doubt get ideas for the adoption of similar principles to their work, for after all it is the fundamental principle underlying the making of any jig that really counts.

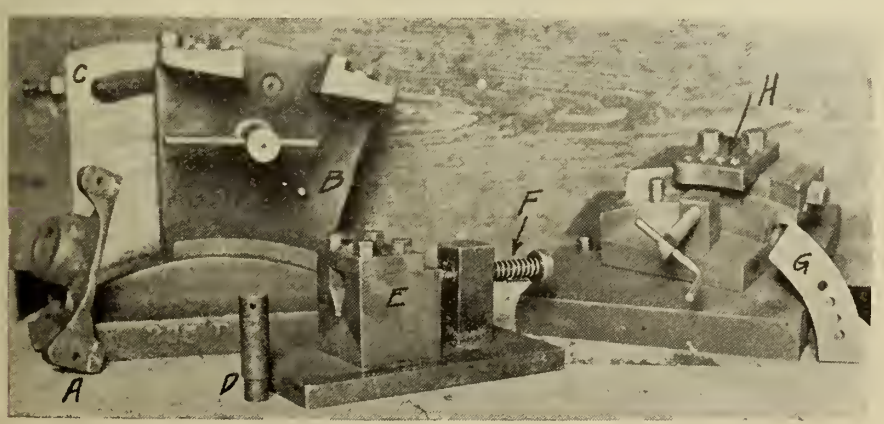


FIG. 5—THREE JIGS, EACH WITH ITS OWN PRINCIPLE.

The Heat Treatment of Locomotive Forgings

The Article Deals Not Only With Locomotive Forgings, But Similar Parts as Well—The Author Presented This Matter Before the Buffalo Chapter of American Society for Steel Treating.

By LAWFORD H. FRY

THIS paper presents some notes on the theory and practice of the heat-treatment of steel forgings with particular attention to larger forgings such as locomotive driving axles and similar parts. In dealing with the theory my idea is to give only a general outline of the metallurgical theories of hardening and to compare these theories with what we see every day in practical work in the treating plant.

The term "heat treatment" is a somewhat loose one. It may properly be used to describe many processes, and some critics assert that it has been used to cover a multitude of sins. In the present paper the term is used to cover quenching from a temperature above the critical range, followed by a drawing at a temperature below the critical range.

Theory of Heat Treatment

The practice of heat treatment as defined above is based on the fact that the quench produces great hardness and brittleness, while the draw reduces the hardness and restores ductility, in proportion to the temperature reached.

It is not too much to say that our present civilization—based as it is on engineering—is dependent on the simple fact that steel hardens on being quenched. In spite, however, of the great importance of the process, and of the amount of research work that has been done on it, there is still room for doubt as to the exact nature of the reactions which produce hardening, and some of the most eminent metallurgists hold divergent opinions on the subject.

We know well enough how the physical properties of the steel are affected by quenching and the microscope has carefully followed and recorded the visible changes in the interior structure of the steel. It is true, however, that the scientific explanation of the hardness produced by quenching still remains no more than a theory, and as yet the most eminent metallurgists are not unanimous in their choice of a theory. The changes in structure as revealed by the microscope can be summed up in a few words. As it comes from the forge the steel has a coarse irregular structure with comparatively large grains of pearlite inclosed in a network of ferrite. On being heated up through the critical range the carbon, to which the pearlite structure is due, dissolves in the surrounding iron so that at temperatures above the critical points the steel becomes a uniform homogeneous solid solution of carbon in iron. By rapid quenching this structure can be preserved into the cold state, and the resulting steel will be extremely hard. If slow cooling is allowed, the carbon comes out of solution as the critical range is passed, pearlite and ferrite re-form and the steel reverts to its former condition except that the grain is refined. The steel is then as soft as or softer than before. An intermediate rate of cooling produces an intermediate structure and an intermediate hardness.

Theories of Hardening

To explain these possible changes in hardness many theories have been offered. Those backed by the best known metallurgists may be collected into three groups and designated:

(1) Allotropic iron theory.
(2) Carbonist theory.
(3) Strain hardening theory.

Osmond in developing his theory of the first group assumed that iron occurred in three forms, or allotropic states, through which it passed with a change in temperature. He concluded that the change from one form to another required time, so that a rapid cooling prevented the iron being transformed to its usual low temperature form, and trapped some of the intermediate form which was hard and brittle at ordinary temperatures.

Arnold attributes hardening to a direct action of the carbon in the steel. He supposes the existence of a carbide of iron called hardanite, which is very hard, and which by being retained on quenching imparts hardness to the steel. It has even been suggested by other exponents of the carbon hardening theory that the sudden compression of the metal on quenching transforms the carbon into minute diamonds which produce the hardness.

In the more modern theories, hardening is held to be produced by the strains set up on quenching. We are all familiar with the fact that if a piece of steel be strained beyond its elastic limit it will be hardened. This has been explained by Beilby by his theory of amorphous vitreous cement. He showed that when the surface of a metal is polished, the pressure used transforms the outer layer from a crystalline structure into a glassy amorphous film which is very much harder than the crystalline material. Recent experiments with balls for ball bearings have shown that the polished skin on the balls adds 30 per cent. to their strength. This hard amorphous material accounts for the increase in strength and hardness produced by cold working. When a piece of steel is stretched or compressed beyond its elastic limit the crystals throughout the metal slip over each other, at each slippage surface a film of hard amorphous vitreous material is produced. The films are too thin to be visible even under the microscope, but are numerous enough to harden the metal throughout. Beilby further noted that the amorphous material reverted to the crystalline condition on being heated. As Carpenter has pointed out the change from the crystalline to the amorphous condition can be effected by work but not by heat, while the change in the reverse direction from amorphous to crystalline can be produced by heat only and not by work.

Beilby's theory having been found to fit all the conditions of cold hardening, was proposed in 1914 by three different groups of scientists as an explanation of the phenomena of hardening by quenching. The form in which the theory was proposed by Edwards and Carpenter appeals to the writer as giving the simplest explanation of the observed facts. An account of this theory is given in the paper on the Hardening of Steel by Carpenter, read before the Royal Institution, March 7, 1919, and reprinted in Engineering, March 21, 1919. It is pointed out there that during the quenching of the steel severe internal strains are set up—

(1) By the shrinking of the outer skin;

(2) By the suppression of the critical change.

These strains develop intercrystalline films of hard amorphous material just as do the strains produced in cold working. The heat in the steel would tend to recrystallize the films, but if the quenching is sufficiently rapid the temperature at which the films are stable is reached before they have time to revert and the metal is hardened. The greater hardness with high carbon is accounted for by the greater strains set up in the suppression of the critical change.

To the practical steel treater it is interesting to have the hardness at which he is aiming thus linked up with the quenching strains which are the source of the difficulties and dangers of the process. If the strain hardening theory is accepted, the process of heat treatment is seen as the art of producing and controlling strains. The first step in the study of the practical application of heat treatment is an examination of the strains produced by quenching.

As mentioned above, Carpenter point-

*Standard Steel Works Co., Burnham, Pa.

ed out that the strains producing hardening might be produced in two ways:

(1) By the shrinking of the outer skin.

(2) By the suppression of the critical change.

I do not know that any attempt has been made to separate the effect of the two classes of strains, or to compare the part played by each. A general consideration of the matter leads to the belief that the strains from skin shrinkage are of secondary importance in producing hardness, but have a primary part in producing troubles. It is to be noted that the strains from skin shrinkage distribute themselves unequally through the pieces, being greatest at the surface and decreasing toward the center. The strains from suppression of the critical change on the other hand have their origin in the interior of each grain and can, therefore, be uniformly distributed throughout the piece. Further these intragrain strains can be produced without distortion of the piece as a whole. It follows, therefore, that the ideal condition in quenching would be reached if it were possible to produce the critical change strains without the skin shrinking strains. Unfortunately this is, from the nature of things, impossible. When the piece is plunged into the bath the skin is chilled first. The skin contracts and is thus put into tension while the interior is in compression. The more rapid the cooling of the skin the greater are the stresses set up, and in the case of a large cylindrical forging such as a locomotive driving axle it is possible by too rapid a quench to split the piece longitudinally. As the piece cools a second danger develops. The outer skin cools and contracts while the core remains hot and expended. To accommodate itself to the core without cracking the skin must stretch. In this stretched condition it becomes rigid, while the core still has a considerable amount of contraction to carry out. Hence in the final stage of cooling the core is pulling away from the skin and if this final cooling is too rapid the core may be ruptured.

Let us now examine the action of the quenching medium on the hot steel. Each particle that is effective in quenching comes in contact with the hot piece, moves along its surface taking up heat for a time, and then is swept away by the convection or other currents in the medium. The amount of heat taken from the piece in a given time will depend on the number of particles brought into contact in that time and on the amount of heat each particle can take up. Hence a light oil quenches quicker than a heavy oil because being more fluid the convection currents bring more particles per minute into contact. Water quenches more rapidly than light oil both because it is more fluid and because each particle can take up more heat. It also follows that a given medium will quench more rapidly if the convection currents are supplemented by a forced circulation. This is illustrated by the figures given below. They are obtained from two similar locomotive axles made from the same steel, quenched from the same temperature in the same medium, a solution of one part cutting compound to three parts water and drawn at the same temperature. For axle A the quenching medium was circulated only by its natural convection, while for axle B vigorous circulation of the medium was obtained by stirring with an air jet. The time of cooling through the interval 1450 degs. F. to 700 degs. F. was decreased from 16 to 9 minutes by this stirring. The physical results were:

Axle	Circulation	Time to Cool from 1450° F. to 700° F. Min.	Elastic Limit Lb. Sq. In.	Tensile Strength Lb. Sq. In.	Elon. in 2" Per Cent.	Red. of Area Per Cent.
A	Natural	16	49,500	95,000	20.5	43.0
B	Forced	9	69,000	105,000	21.0	42.0

Comparative figures for the quenching speed of different media are given in Table I. These are obtained from experiments made with locomotive axles, and while they are perhaps not universally applicable, they serve as a basis for illustrating the difference in cooling rates, and the differences in stresses set up by quenching in the different media. To see the effect on the stresses produced consider a section of the piece quenched having the face A A A A in contact with the medium, while the face B B B B is towards the hot interior of the piece. The cooled face A will contract while the face B is kept hot and expanded. This strains the material. The strain which we can measure most conveniently by the stress it sets up will depend on the difference in temperature between the faces A and B, or, more strictly speaking, on the temperature gradient between the two faces. The faster the heat is taken away from the face A the greater the temperature gradient and the greater the stress. The tables show the calculated figures for temperature gradient and stress for the various rates of cooling.

The effect of the size of the piece must now be considered. The time required to cool a piece of steel through the critical range depends on the rate at which heat is taken out per unit of surface and also on the amount of metal back of each unit of surface from which heat has to be extracted. For example, a bar 1 inch in diameter has 0.25 cu. in. of metal for each square inch of surface, while a 10 inch. bar has 2.5 cu. in. of metal per square inch of surface, that is, 10 times as much metal to be cooled through each square inch of cooling area. Therefore, cooled in the same medium the 10 inch bar would take something like ten times as long to cool through the critical range as would the 1 in. bar. This effect of size is clearly shown in the difference in physical properties between large and small parts when both are given the same treatment. Table 2 gives the results of an experiment to illustrate this point. From two locomotive axles test pieces were cut with a hollow drill before treatment. These pieces about 1¼ in. in diameter by 5 in. long were put back into the hole from which they were cut and the axles heated for quenching. Just before quenching the pieces were taken out of their holes and quenched independently of the axles, but at the same time and in the same medium. They were then put back into place and the axles drawn back. The physical properties of the test pieces and axles are shown in the table. It will be seen that the test pieces are considerably harder than the axles. As a further example of the effect of size Tables 3 and 4 have been compiled showing the physical properties of large and small axles quenched in oil and of small test pieces quenched respectively in air, oil and water.

The property most affected is the elastic limit which is about 50,000 pounds per square inch for the 12 in. locomotive axles and 57,000 to 59,000 pounds per square inch for the five and six inch trolley axles. Test piece No. 6, which was 1½ in. in diamter, quenched in the same oil as the axles, gave 93,500 pounds per square inch elastic limit. The steel in all cases is a carbon steel with about 0.50 per cent. carbon.

Column 4 gives the approximate time taken to cool from 1450 deg. F. to 850 deg. F. The elastic limit (hardness) in-

TABLE 1.

Quenching Speeds, Temperature Gradients and Stress Due to Temperature Gradient with Various Quenching Media.

1 Quenching Medium.	2 Rate of Cooling in B.t.u. per sq. ft. of Surface Per Hour.	3 Temperature Gradient in Deg. F. Per Inch of Thickness.	4 Stress Due to Temperature Gradient in Lb. Per. Sq. Inch for Each Inch of Thickness
Air	8,000 B.t.u.	22° F.	4,000 lb. sq. in.
Heavy Oil	20,000	55	10,000
Light Oil	30,000	83	15,000
Water	60,000	175	30,000

TABLE 2

Effect of Size of Piece Quenched on Physical Properties

1 Axle No.	2 Size of Piece Quenched	3 Elastic Limit Lb. per sq. in.	4 Tensile Strength Lb. per sq. in.	Elongation in 2" %	Reduction of Area %
1	Axle	65,500	124,500	13.0	27.5
1	Test Piece	75,000	134,500	17.0	43.5
2	Axle	45,500	89,000	25.5	49.5
2	Test Piece	56,500	99,000	23.0	52.0

TABLE 3
Size and Physical Properties of Various Forgings

1 Line	2 Material	3 Diameter O.D.	4 Bor.	5 Appr. Wgt.	6 Qnch.	7 Draw	8 Elastic Limit	9 Tensile Strength	10 Elong. in 2"	11 Red. Area
1	Loco. Axles	12"	3"	2000	1450 Oil	1050	51,500	97,000	22.0	53.0
2	Loco. Axles	12"	3"	2000	1450 Oil	1050	50,000	98,000	24.0	46.5
3	Trolley Axle ..	6"		840	1450 Oil	1050	59,000	107,500	24.0	51.0
4	Trolley Axle ..	5¼"		650	1450 Oil	1050	57,000	90,000	25.0	49.0
5	Test Piece	1½"		1.6	None	1450	77,000	124,000	16.5	39.0
6	Test Piece	1½"		1.6	1450 Oil	1200	93,500	128,000	19.5	51.0
7	Test Piece	1½"		1.6	1450 Water	1200	112,000	125,000	19.8	55.5

TABLE 4
Quenching Speeds and Physical Properties

1 Line No.	2 Material	3 Treatment	4 Approx. Time to Cool from 1450° F. to 850° F. Min.	5 Elastic Limit Lb. sq. in.	6 Elastic Ratio %	7 Tensile Elongation Factor
1	Loco. Axle	Quench Oil	20	51,500	53	2,140,000
2	Loco. Axle	Quench Oil	20	50,000	51	2,350,000
3	Trolley Axle	Quench Oil	15	59,000	55	2,580,000
4	Trolley Axle	Quench Oil	15	57,000	63	2,250,000
5	Test Piece	Cool in Air	6.5	77,000	62	2,040,000
6	Test Piece	Quench Oil	1.8	93,000	73	2,500,000
7	Test Piece	Quench Water	1.0	112,000	90	2,480,000

creases steadily as the time of cooling is reduced. Test piece No. 5, which was cooled in air, coooled more rapidly than the quenched axles and is consequently harder. Micro-photographs of the three test pieces quenched respectively in air, oil and water show a fineness of grain in proportion to the rapidity of cooling, but this is an accompaniment of the hardness and not its cause.

Coming now to the application of the principles we have considered, let me present some notes on the practice of the works with which I am connected. Before the war our heat treating experiences covered locomotive forgings.

With the entrance of this country into the war we were requested by the Government with all the force of a command to undertake the manufacture of nickel steel forgings for the 155 m/m guns and howitzers. Of these forgings the largest piece is the gun tube which is about 20 feet long with a bore 5½ in. at the breach and 9½ at the muzzle, the weight being about 3,900 pounds.

Under the advice of the Ordnance Department, we put in vertical oil fired furnaces and experience led us to choose water as a quenching medium.

In gun manufacture the tests are taken two from each end of each forging transversely, that is to say, the axis of the test piece is taken across the direction of forgings. As a consequence, if the steel is fibrous, the fibre runs across the test specimen and the latter fails to give proper elongation. This trouble cannot be eliminated by heat-treatment, as it is inherent in the steel. I think it is safe to say that with a properly operated treating plant, at least ninety per cent. of the trouble encountered has its source not in the treating plant, but in the open hearth where the steel is made.

In the gun treatment the greatest chance of purely treatment trouble lies in the time of immersion in the water. It has been pointed out that if the final cooling of a quenched piece is carried out too rapidly quenching cracks may be produced. The nickel steel gun forgings with their varying sections proved to be very susceptible to this trouble. Finally we developed the practice of varying the quenching time to suit the varying sections of the piece. For example the gun tube would be completely immersed and quenched for two minutes, then the thinner muzzle section withdrawn and the heavier breech section given another minute in the water. As a rough approximate figure it was found proper to give an immersion of one minute for each inch thickness of wall in the forging.

In returning to a peace basis of manufacture, the equipment and experience obtained in gun making is available for the manufacture of locomotive forgings. The first question that arises concerns the relative merit of oil quenching as formerly practiced and of water quenching as used for guns. In giving preference to water we follow the lead of the Pennsylvania Railroad, who have been pioneers in the introduction of heat-treated locomotive parts. Of the two media, water by reason of its drastic quenching power takes first place in the production of desired physical properties in the steel. Any argument in favor of oil is based on the danger of quenching cracks if water is used. The answer to this is to have a carefully organized shop and to watch closely the time that the material is left in the water.

In conclusion I sum up the requirements in successful heat treatment as follows:

1. Select sound, well-made steel.
2. Heat uniformly to the proper quenching temperature.
3. Quench rapidly but withdraw from the bath at a sufficiently high temperature.
4. Draw uniformly and accurately.
5. Submit to a shock proof test before putting into service.

By correct practice along these lines the steel will give from 40 to 60 per cent. better service than the same steel untreated.

(Acknowledgment to Mr. H. P. Tiemann is due for assistance obtained from his book, "Iron & Steel.")

TRAINING THE WORKERS

The General Electric Co. has established in connection with its educational system a business training course for college graduates without technical education.

According to the company, this course is aimed to give training in the principles of higher accounting, a knowledge of which is of great importance to those who hope to become executives; to explain the essential elements of business law made necessary by Governmental supervision of corporations, the tax laws, and other complexities of our modern economic life; and lastly, to apply this general knowledge concretely to the business of the company, which is necessarily intricate owing to the size of the organization, the volume of its sales and the wide range of articles manufactured.

The training course consists of actual employment during the business day, in one of the departments where the student will become familiar with the practical work and the departmental functions. The class work will engage the best efforts of the student for eight or ten hours each week outside the class periods, which are held two evenings a week from 5.30 to 7.30 p.m. The course is divided into semesters and is in progress during the usual months of the college year.

In a paper entitled: "Some Aspects of Electrolysis of Pipes," presented to the American Waterworks' Association, Professor G. Alleman points out that damage only occurs where the leakage current either enters or leaves the pipe. It can be easily calculated that one ampere flowing continuously from an iron pipe for a period of one year is equivalent to 20 pounds of iron or 74 pounds of lead, and it must be remembered the current which leaves the pipe at one point may return at another place if the electrical conditions are favorable. In consequence, and as supported by experience, the effect of the current may correspond to any multiple of these two equivalents. Iron pipes are not corroded when electrically negative, and the opposite condition applies to lead pipes, but it is also possible under certain conditions for lead pipes to be corroded when electrically negative.

The British American Shipbuilding Co. has closed its doors and the activities of one of Welland's foremost industries are ended. The loss of this splendid industry is a serious one, and hopes are entertained that the plant, which is for sale, will be purchased.

A Real Home for Out-of-Town Apprentices

Realizing That Many of Their Apprentices May Be Out of Town Boys, This Concern Has Set Aside a Special Home for Their Use—Read the Particulars, It is Well Worth While.

By J. M. HARRISON

NO doubt many an old timer will remember the period when machinist apprentices worked for the handsome sum of 75 cents weekly. The writer himself did not come under such a classification, but received the small fortune of $3 for his initial year at the business. Contrast the two former conditions with those of the present day. An apprentice receives a better salary, works under better conditions, and in every respect has a real chance to advance. In some plants, including the one we will mention later, apprentice classes are formed, and in these classes are taught the different branches of mathematics. Some concerns hold these lessons right in their plant, while others send the boys to some nearby technical school, but in either case the principle is the same.

The chief aim is to advance the apprentice as speedily as possible, allowing him to obtain both the practical and technical knowledge. In the old days if an apprentice made up his mind to reach more than the usual standard, it meant burning the midnight oil, and plunging into whatever textbooks he could find on the subject. These unfortunately were sometimes not of the highest order.

The young chap learning his trade at the present time has very little excuse to offer if he does not advance in his profession, for even should his concern not hold apprentice classes as already described, there is always the modern technical school evening classes which are open at a very low cost. Competent instructors are there to see that the boys following up their various professions get a thorough technical training, and it depends on the interest taken by the student what the final result will be. be.

The well-known firm of Brown and Sharpe Manufacturing Co., Providence, R.I., have always been noted for what they have done for their apprentices, but they have added still another feature of interest, namely, a home for out of town apprentices.

Realizing that many of their apprentices may be out of town boys who are taking the training in their apprentice department, they have set aside the home as shown in the photograph for such lads. It is located in a good residential section of the city, and is only a short distance from the works.

On the ground floor are the housekeeper's apartments, two sleeping rooms, a living room and a closed in sun porch. On the upper floors are good sized halls, sleeping rooms, toilets and a large wash room containing lavatories and shower baths. Hot water is always available from an automatic heating system, and there is steam heat in every room.

Each boy has an extra width spring cot with mattress, pillows and bedding of the best quality, a chiffonier, an armed rocker and rug, and each room contains a study table and chair. There is no gas in the boys' apartments, all lighting being by electricity. Bath and hand towels are furnished and these, together with the bedding, are laundered by their own electrical equipment in the basement of the house.

The living room is furnished with an aim toward comfort and homelike environment, and a cabinet Victrola adds to the enjoyment of the evening and week-end hours of the boys. A supply of magazines is always on hand and through the extension service of the Providence Public Library the book shelves are kept filled with good, wholesome reading matter. The closed in sun porch, opening through French windows from the living room, makes an attractive place for lounging and games.

The house is under the supervision of the apprentice department, but is directly conducted by a responsible housekeeper and an assistant. There are no set rules, the boys simply being asked on coming into the house to do there as they would in their own homes. The policy is to maintain a thoroughly homelike atmosphere and to avoid the institutional tendencies often evident in such places.

No meals are served, but there are boarding places nearby where board may be obtained at the current rate. Room rent is not taken out of the pay, but each boy pays the housekeeper a fair amount weekly, this charge including the towel service.

Application for a room is made with the application for an apprenticeship by sending a note with the application or by writing on the margin of the appli-



APPRENTICE HOME OF BROWN & SHARPE—EXTERIOR AND LIVING ROOM.

cation blank. If there are no openings when the apprentice begins his course his name is placed on the waiting list and he is helped in finding a satisfactory room to use until there is a vacancy in the dormitory. Some of these temporary rooms are with families of men long employed by the company.

Our boys like to live at "Apprentice House." It is clean and quiet, and affords opportunities for good companionship that may well be compared with the valuable associations of a college fraternity house.

A scheme such as this is to be highly commended, and it goes to show how much this concern has the interest of their apprentices at heart. No wonder the boys like to live at such a house, for under such careful management it is always kept clean and quiet, and affords opportunities for good companionship which may well be compared with the system adopted by various colleges.

HANDY INFORMATION

In the September copy of "Threads" there is some information which is well worth reprinting. The matter we refer to is used in the "He wants to know" section, and here are the questions asked, and the answers given.

The first deals with information on the tolerance of diameters of screws before threading, the answer being as follows:

The best practice is to have the stock turned to correct diameter before running the thread chasers on. When the stock is much oversize, it puts the die head in a very bad position, acting both as a milling tool and a threading tool.

This one point causes as much screw threading trouble and breakage of chaser teeth as any other one cause.

A customer has been successful in threading ⅜-inch—16 malleable iron lugs with a geometric threading machine, where the thread was cut directly on the casting, the pieces being 1-32-inch oversize, rough, and the threading operation reduced the diameter to about 1-64-inch under size, because the pieces were galvanized after threading. The chasers threaded 1,000 pieces between grinds. This customer referred to their work as "a strenuous job."

The next question was this "Are high speed steel chasers preferable to carbon?"

High speed steel chasers are used when speed is the chief consideration. They are not recommended where an especially fine finished thread is required. On a thread for what might be called a commercial finish, and where quantity rather than quality is desired, high speed steel has the advantage. High speed steel thread chasers are not recommended for cutting brass, for they have a tendency to stick to the work.

Fine finish and highest speed do not go together, and where threads of fine finish are required carbon steel chasers must be used. All grades of carbon steel are of much finer grain than high speed steel.

The next item is an answer rather than a query, and is presented in letter form as follows:

In the July, 1920, issue of your joyful little publication is stated the fact that you know of no satisfactory method of measuring internal threads except with standard plug gauges. Undoubtedly this is the most generally adopted method for production work, although there is a formula and method which is given in Communication B 523 of the Gage section of the Bureau of Standards. The formula is as follows:

$$E = M - \frac{\cot a}{2n} + G\,(1 + \text{cosec. } a)$$

in which E=pitch diam.; M=measurement between balls; n=No. of threads per inch; G=diam. of balls; a=half of included angle of thread.

Instead of wires as used on plugs or external threads, balls of the diameter best suited to the size of the thread are used and the measurement between these made with gage blocks in combination with a slide parallel in order to secure the correct adjustment and pressure.

I think that this is the formula which the party desires, but is practical only in exceptional cases on ring thread gauges.

Next on the list comes this query: "Why should two chasers do the cutting while the others of the set do none?" Here is the answer:

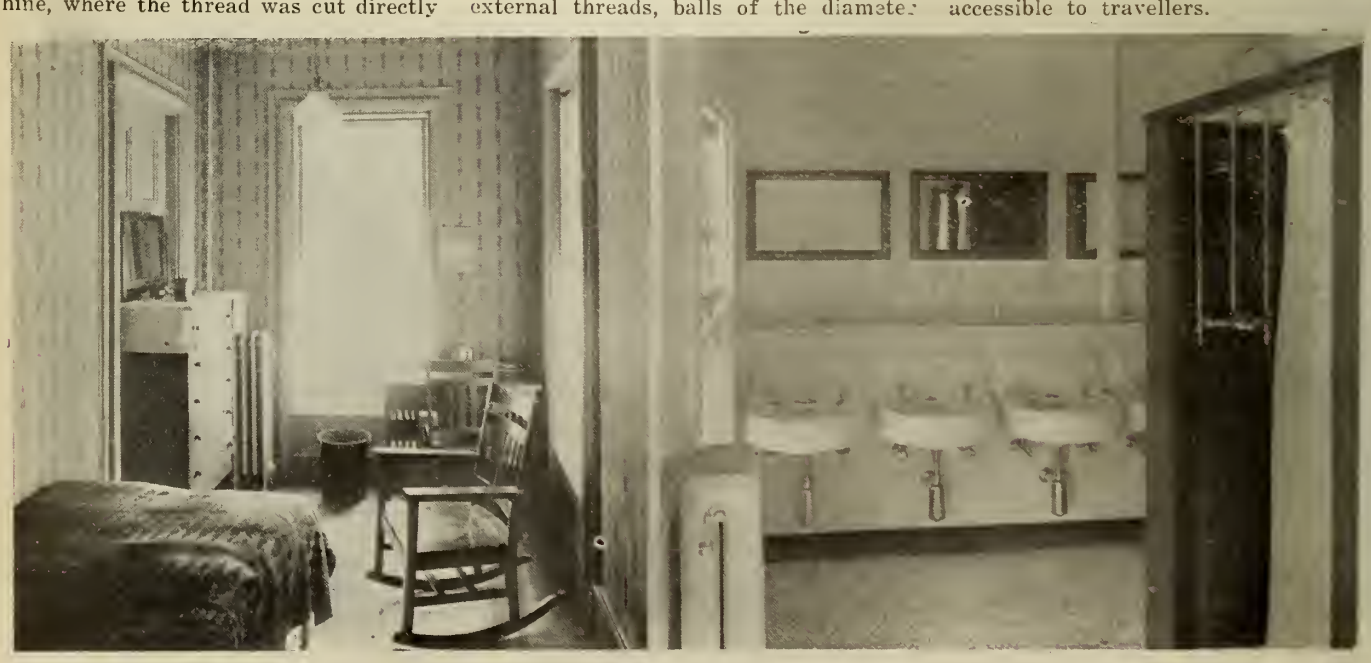
Uneven chamfer is most likely the cause of this unequal cutting. Prove the chamfer even from the cam slot. The grinding should be done from the keyway and not from bottom or top of chaser. The cam may be out of true, and cause the condition; or, possibly, the distance from the cam slot to the cutting face of the chasers is not true.

Lastly we have this one: "A 1½-inch collapsing tap does not always close up, and often tears the threads."

It is probable that the threads, when tearing, clog the chasers and hold the tap stiffly, so as to interfere with its collapsing properly. Our suggestion is to try grinding the chasers with a slight hook, which will, no doubt, stop the tearing of the threads. The cam spring in the tap may have become weakened, and this would account for the tap not closing. A weakened cam spring could readily be replaced by a new one.

The beauty of presenting these excerpts is that the very problems under discussion may help you solve a similar difficulty.

A movement is under way at Windsor to maintain a floating hotel to relieve the lack of hotel accommodation in the border cities. President Bourke, of the Great Lakes Transportation Co., declares his willingness to moor one of the company's vessels where it would be easily accessible to travellers.



ONE OF THE SLEEPING ROOMS AND WASH ROOM IN BROWN & SHARPE APPRENTICE HOUSE.

Gears From a Purchaser's Standpoint

By D. G. STANBROUGH

IN a paper read before the American Gear Manufacturers' Assoc. convention at Detroit, the author deals with questions relating to personnel and organization, labor market, plant buildings, and equipment, in so far as these affect the gear-manufacturing industry. He next dealt with the fact that satisfactory gears from a purchaser's standpoint can only be produced as a result of conformity to good practice along the following lines: (1) Design; (2) materials; (3) forgings and castings; (4) heat-treatment; (5) machining; (6) hardening, and (7) inspection.

There are certain fundamental considerations of design, he said, that can be counted upon to produce good gears, although a partially satisfactory product may be turned out if all of these fundamentals are not strictly adhered to. The good features of gears are uniform sections and a tooth form which will meet all the requirements as to strength. The design must also take into consideration the practice of the plant in which the gears are to be manufactured. Take, for instance, the familiar cluster gear used in automobiles. This cluster can be made from the blank with integral gears, or can be made with three integral gears and a fourth gear riveted or fastened to a flange. In the first case, a certain method of cutting has to be employed, and there will be unquestionably a considerable loss from warpage in heat-treatment. In the other case, the loss from warpage is reduced, but, on the other hand, considerable grinding is introduced, and a nice fitting job is necessary. The decision as to the design should naturally rest with the practice of the shop. Good gears can be produced by either method, and the one to be adopted depends more upon which is in vogue than upon any technical consideration as to the results that can be obtained with either method.

Method of Mounting

Another big thing which needs careful attention in designing gears, if satisfactory results are to be obtained, is the method of mounting. The best cut gear that can be made will not give satisfaction unless properly mounted. Many a noisy gear would not be noisy if it were run on quiet bearings. The mounting of gears should be such as to take care of the stress incident to the pressure angles. The shafts should be stiff, the mounting rigid, and the bearings as close to the centre of the load application as it is possible to make them. In designing a gearcase, strains should receive careful consideration. The manufacturer cannot be expected to turn out a finished product which conforms to the customer's specifications unless the product be given at least fair conditions under which to operate. Much time and energy can be saved by giving more consideration to the design of gear mounting before the manufacturing work is undertaken. Too little attention has been paid to the mounting of gears by designers in the past. The manufacturers can do the purchaser a favor by pointing out the deficiency in design before undertaking contracts.

Materials for Gears

In selecting the materials from which gears should be manufactured, the conditions under which the gears are to be operated should be considered. First, those subjected to practically no stress and very little wear should be made of bronze, cast iron, untreated bar stock, and aluminum. Second, if the service will produce great wear, but not severe stresses, the material should be "straight" carbon steel, and should be carburized. Third, if the gears are subjected to extreme wear and considerable stresses, they should be made from forgings of alloy steel, and should be carburized. Fourth, where severe impact and other stresses are involved with a normal rate of year, high-grade alloy steel forgings should be used, oil-treated and not carburized. Fifth, where the gears are to be subjected to extreme wear and extreme stresses, they should be made from self-hardening steels which have been forged.

Castings and Forgings

No serious difficulty is encountered when the gear blanks are cast, although it is important to keep the sections uniform in order to guard against shrinkage cracks, especially in the case of gear blanks made from steel castings. With cast iron it is important, in order to obtain long life, that the combined carbon be high, and that the metal be cast so that the blank will be chilled, thereby retaining a sufficient quantity of the carbon in solution. The blanks should not be so hard that they cannot be machined without annealing, the most satisfactory results being obtained with a scleroscope hardness of about 35; the combined carbon content should be between 0.30 and 0.50 per cent. No particular difficulty is experienced with bronze and aluminum castings.

The forging of gear blanks represents a considerable problem. The temperatures at both the beginning and end of the operation should be held within certain well-defined limits, according to the forging temperatures of the steels being used. High temperatures produce burnt gears, which sometimes can be used only after an expensive corrective treatment process has been employed. A low finishing temperature results in cold strains which, when relieved in heat-treatment, reveal cracks, seams, and fissures. Another phase of the forging of gears is in regard to the type of forging machines employed. Generally speaking, the flow lines of the metal in a forging should be at right angles to the forces applied to the gear teeth while in operation. It follows, then, that a gear that is flat can be produced under a drop-hammer, while gears having bosses, and those in which length is the predominant feature, can best be produced by a forging machine. The size of the hammer has an important bearing on the subject; a large gear cannot be satisfactorily forged under a light hammer, as the time required to close the dies permits the gear to cool and results in too low a finishing temperature.

Preliminary Heat-Treatment

Practically all gears that have been forged should be given a preliminary heat-treatment before machining, particularly those gears that will be subjected to great stress and that must be practically free from distortion after hardening. On mild steel this initial heat-treatment consists simply of annealing or normalizing. Normalizing the steel eliminates whatever stresses have been set up in the forgings and renders the gears suitable for machining. On the alloy and high-carbon steels the normalizing treatment is not sufficient. Gear blanks made of these steels are first quenched from a suitable temperature and then drawn sufficiently to enable them to be machined.

Machining of the Blanks

In manufacturing gear blanks it is important that the surfaces be held parallel and that they be machined true with the holes in the blanks. In the author's experience, broaching will produce a straighter hole than reaming. Gears that have splined holes should be machined from the splines, both in the blanking and cutting operations. It is also essential that the pitch line of the gear be concentric with the hole.

Probably the simplest method employed for locating the gears when finish-grinding the bores and faces is the one in which the work is located from the periphery. Another method employed is that in which the gear is located from the root diameter; and still another method—and the most difficult of the three—is that by which pins carried in the chuck contact with the gear teeth at the pitch line. Locating a gear from the root diameter is the most practical method. When this practice is followed it is necessary to finish-cut the root diameter. This method also enables the locating pins in the chuck to be made stationary for each size of gear, which is

(Continued on page 339)



WELDING AND CUTTING



Possible Economies in the Application of the Oxy-Acetylene Process

THE following article, by the secretary of the French Acetylene Association, on possible economies in the application of the oxy-acetylene process, is both timely and of great interest.

The cost of blowpipe welding has increased to such an extent compared with other methods of making joints that there is a risk of its remarkable progress being stopped. An investigation to determine what methods should be adopted to avoid this reveals the fact that economies of all kinds can be realized in the application of the process. With the present day methods economy in one way or another will give a total saving of 20, 30, 40 and even 50 per cent.

In the first place consider the raw materials which at the present time are so costly. How many firms call for a test of their supplies of oxygen and carbide? The majority of users of the process assume that there is only one quality of carbide, and consequently the question of whether the carbide is good, bad, or indifferent never crosses their mind. Suppose, for example, carbide is bought yielding 200 litres of acetylene per kilogramme of carbide instead of 300 litres, unless a repayment claim is made based on the analysis, the cost to the buyer is increased by one-third, to say nothing of the impurities in the gas, which accompany inferior carbide, or the additional manipulation necessary.

Regarding Oxygen

With regard to oxygen, in France it is guaranteed to be 95 per cent. pure, but very few firms test to verify this degree of purity. Suppose, for example, it is not more than 90 per cent. pure, a fact which would not be discovered when using a welding blowpipe, the buyer's costs are increased by at least 12 per cent.; of this figure 5 per cent. is loss in purity of the gas and at least seven per cent. due to the reduction in the speed of welding. The welds produced are also distinctly inferior.

The utilization of carbide and oxygen calls for economy. Certain acetylene generating plants will, through excess production and bad design, discharge into the atmosphere one-quarter and even one-third of the gas developed. With others the generation is accompanied by intense polymerisation, as is shown by the colour and nauseous odour of the residue; the loss in this case may be from 20 to 30 per cent. Again, there are avoidable losses in charging and cleaning, using wrong sizes of carbide, and wastage of small carbide. There may be small leakages in the apparatus, at the joints and valves, which in the aggregate amounts to considerable waste and represents appreciable loss.

In the case of oxygen, how many firms check the cylinder contents or possess an accurate pressure gage for this purpose? Suppose, for example, the pressure is 100 or 110 atmospheres instead of 120, there would be a loss of 10 or 15 feet of oxygen per cylinder, which, at the present price of oxygen, might mean considerable loss. There may be a leakage at an oxygen valve, or through a defective regulator, or through porous flexible hose, or through a defective union or connector, consequently it is not difficult to use almost 200 cubic feet of gas where 100 cubic feet should be used. There is also considerable loss in the return of empty oxygen cylinders. Frequently, owing to lack of supervision, carelessness or negligence on the part of the welder, cylinders are returned containing gas at a pressure of 80 pounds per square inch and upwards. It is not uncommon to find full cylinders mixed with empty ones.

The Blowpipe

Consider next the blowpipe. This offers a very large field for economy. It is well known that the consumption of oxygen and acetylene should approach equal volumes and that the average for well-known blowpipes will work out about 1.2 to 1.3 cubic feet of oxygen for each cubic foot of acetylene. But if consumption tests are made in any workshop it will be found that the figure is nearer 1.8. In other words, there is a waste of half a cubic foot of oxygen per cubic foot of acetylene used; thus, with a blowpipe consuming 20 cubic feet of acetylene per hour there is a waste of 10 cubic feet of oxygen per hour, in addition, the speed of welding is reduced and the welds inferior.

The rates of the consumption of oxygen to that of acetylene does not entirely depend upon the type of blowpipe used, it also depends upon the proper maintenance and the working condition of the blowpipe, and, in a very large measure, upon the pressure at which the oxygen is used, a pressure which is invariably too high.

With regard to the actual welding operation, there is the case where a blowpipe of insufficient power for the work in hand is used, as a result of which the welding speed is too slow, even for the expenditure of gases. If the blowpipe is too powerful it is necessary to raise the flame in order to avoid holes; in this way heat is wasted and, of course, oxygen and acetylene in addition to the loss of time.

In one workshop we found for a given class of work that 12 feet per hour was the speed of welding, whilst in another works doing exactly the same work the number was 18 feet, and the welds were good and carefully executed. This result, which shows an economy in gases and labor of 33 per cent. is simply due to the better preparations and better execution of the welds.

Welding Backward

It has been shown that the new method of executing welds known as welding backwards and which can be applied to an immense variety of steel welding, varying from ⅛ to ½ inch in thickness, will give an economy in labor and gases of at least 25 per cent. How many firms have studied this important development and applied this method?

There are also important economies to be shown when well designed and appropriate jigs are used, when the edges are well prepared, and when the comfort of the welders is studied. The blowpipes which burn in the air whilst a welder turns the work, searches for a welding wire or, perhaps, rolls a cigarette, are wasting unnecessarily the principal materials which, as we know, are very dear.

The objection might be raised that it is an easy matter to describe methods of economising but in industrial application the proposals become more or less theoretical. Our answer to that is that the figures and methods of economising spoken of have been obtained and applied in the welding firm of Girel & Co. This firm employs 500 welders and consumes about 150 tons of carbide per day and 110,000 to 130,000 cubic feet of oxygen per day. The carbide and oxygen are analyzed on their arrival and the contents

of the cylinders verified on receipt and in returning them; the yield of the generating plant, tests or leakages, the overhaul of blowpipes and regulators, are made a regular part of the work. Records as to the oxygen used daily by each welder are kept, so that it is an easy matter to determine the consumption of acetylene and thus to fix the cost per foot of welding, and then to constantly endeavor to lower the cost by a better utilization of the flame, using better devices for assisting the welding operator, etc. As a part of excellent collaboration on the part of the several foremen, the foreman welders, and the welders themselves, and the excellence of the materials used and the general organization, we have obtained results which, in these days, would be considered remarkable. As an example, in manufacturing certain articles which other workshops were also engaged upon, the cost of oxygen and acetylene was only one-half of that of other important firms. The production for the same amount of labor was double that of other firms, and finally, after Government inspection of the work, there were no rejections.

This is only one example where great economy has followed the paying of attention to the points indicated. It is certainly time that all firms engaged in welding operations paid more attention to the economical side of the process if only from the point of view of the quality of the work.

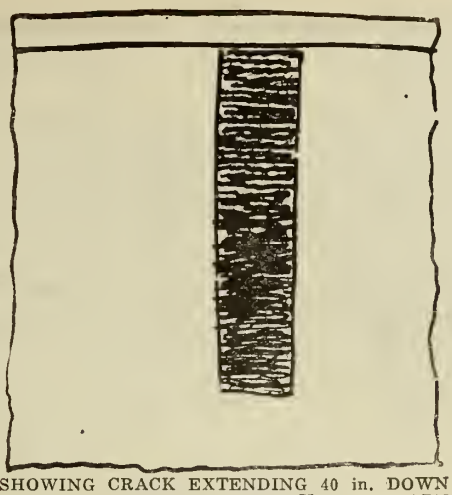
AN UNUSUAL WELD

A repair job of interest to all engineers was recently carried out by means of the electric arc welding process to the main engine cylinder of the steamer Chippewa.

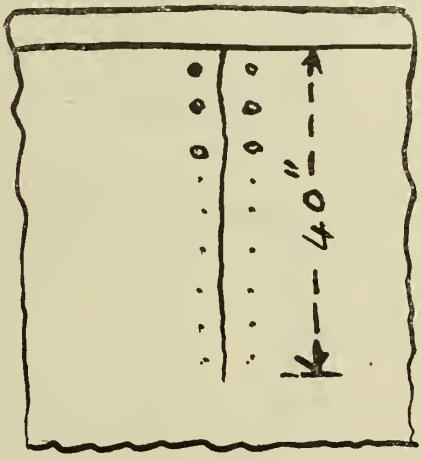
Our readers will be familiar with the Chippewa's old-fashioned beam engine or "walking beam," as it is sometimes called. Needless to say the engine only has one cylinder, so that when a vertical crack some 40 inches long developed in the cylinder wall during the busiest part of the season, something had to be done about it. The cylinder is 5 ft. 6 in. in diameter by 12 ft. long, and carries a working pressure of 60 lbs. per sq. in.

After consultation with the Lincoln Electric Co. as to the possibility of successfully welding the crack, it was decided to proceed with repairs as quickly as possible, by means of a method which has been very successful in repairing large iron castings subject to heavy working stresses.

Holes were drilled down each side of the crack, and steel studs were screwed in and cut off about 3-4 in. from the cast iron. By the time the last stud was in, the Lincoln Electric Co's. motor truck carrying the portable electric welding outfit was on the dock within 20 feet of the Chippewa's engine room. The cables were connected up and the welder went to work to weld those studs and the cast iron of the cylinder into a solid mass of metal. Twenty-four hours later the job was complete and shortly afterward the Chippewa steamed out into the lake for a trial trip.



SHOWING CRACK EXTENDING 40 in. DOWN FROM TOP OF CYLINDER, STUDDED READY FOR WELDING.



FINISHED WELD RESEMBLING STEEL PLASTER ABOUT 1 IN. THICK, APPLIED TO OUTSIDE OF CYLINDER WALL FOR FULL LENGTH OF CRACK.

Note:—It was found that this method of welding had the effect of drawing the edges together and closing up the crack as the weld was made, from the bottom up.

The weld was found to be quite tight and appeared to be a perfect job. The Superintendent Engineer deemed it advisable, however, to make assurance doubly sure by re-inforcing the weld with two steel bands placed right around the cylinder.

Electric arc welding has been used extensively of late along the water-front in Toronto for boiler and hull repairs but this is one of the first local instances that has come to our notice of the use of the process for a major repair to a large and important iron casting.

There was recently put into service in America, at the Government League Island Navy Yard, Philadelphia, a crane which is described in the General Electric Review (U.S.A.) as the largest hammer head type fitting-out crane which has yet been built. The crane is approximately 250 feet high overall and can handle a 350-long-ton load at 115 feet radius, and a 50-long-ton load at a 190 feet radius. The maximum lift of the main hook from the deck of the pier on which the crane is located is 145 feet, but the drum holds sufficient cable so that the hook can be lowered 25 feet below the deck of the pier, making a total lift for the main hook of 170 feet. The 50-ton hook has a maximum lift of 180 feet. The total length of the swinging jib is 300 feet, of which 100 feet is on one side of the centre line and contains the machinery house and counterweight, while the other 200 feet is on the opposite side of the centre line and contains the runways for the trolley carriages.

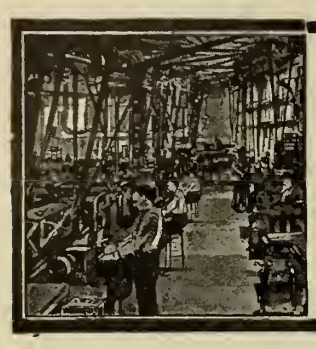
HEAT TREATMENT OF STEEL

In a paper recently read before the Detroit Convention of the American Gear Manufacturers' Association, Mr. G. W. Yale advocated the use of the electric furnace for the heat treatment of steel. A lead bath or an ordinary coal or gas fuel furnace has, he observes, a very great heat capacity, and is accordingly but little cooled down when the material to be heated is placed in it. The consequence is that small parts heat up more quickly than large ones and the result is often disastrous. He considers for example, the case of a "chunk" of steel 4 in. in diam., with a spur 1-4 in. thick which is put into a big furnace or lead bath at a temperature of 1,500 deg. F. The bath or furnace is chilled but slightly, and the spur being small in volume heats up rapidly and gives a large grain structure, whilst the heavier portion becomes heated more slowly.

Steel expands when heated, both when the temperature is below and when it is above the transformation point, but at the actual transformation point it contracts, and hence if different portions of a mass of steel under treatment pass the transformation point at different times, distortions are likely to occur, and there may be cracking and failures.

If the same piece of steel be heated in an electric furnace of small heat capacity, the furnace is chilled when the steel is placed in it and the temperature can then be raised slowly, in which case both light and heavy portions of the article under treatment pass through the transformation point at the same time.

Although the cost of electric heating per B.Th.U. developed, is much higher than in direct heating by coal, gas or oil, the cost per B.Th.U. usefully employed is not very different, since, with electric heating, the heat is generated just where required, whilst with other systems of heating 60 per cent. to 80 per cent. of the total heat passes off up the chimney. The labor costs are also markedly different since with direct heating the total cost of the labor includes that expended in cleaning off scale, straightening warped pieces, or grinding operations, which are said to be unnecessary when the heat treatment is conducted along the lines which Mr. Yale advocates. Taking the case of such articles as automobile gears, it is stated that two men can, with the electrical method, turn out 2,000 lb. and 2,400 lb. of treated metal per day.



DEVELOPMENTS IN SHOP EQUIPMENT



CONTINUOUS MILLING MACHINE

THE machine about to be described is the product of the Newton Machine Tool Works, Inc., Philadelphia, Pa., and is known as the first model continuous milling machine. Figs. 1 and 2 will give readers a good idea of its general appearance without work or cutters, and starting from this point we will discuss a few of this machine's features as spoken of by the makers.

The column and base are a one piece casting in order that all strains resulting from bolted joints may be obviated. The table is circular in form, with special provision for mounting the various forms and types of holding devices as is required for the rapid machining of a variety of parts. It will be observed that this table is adjustable upon the base in order to provide for the proper positioning of the jigs carrying the work in relation to the cutters, in order that the work may be placed upon the smallest possible radius, and utilize the least possible diameter of cutter.

It will be realized the advantages of

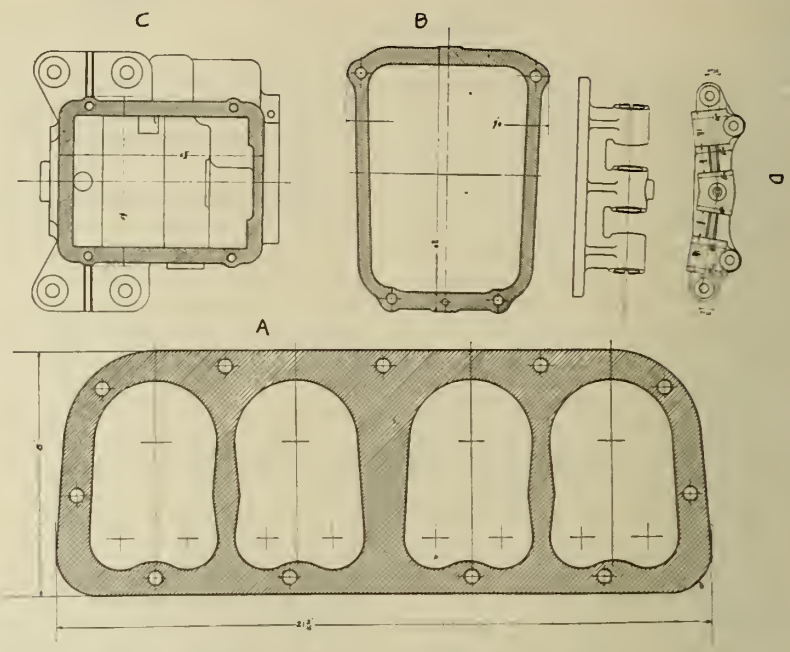
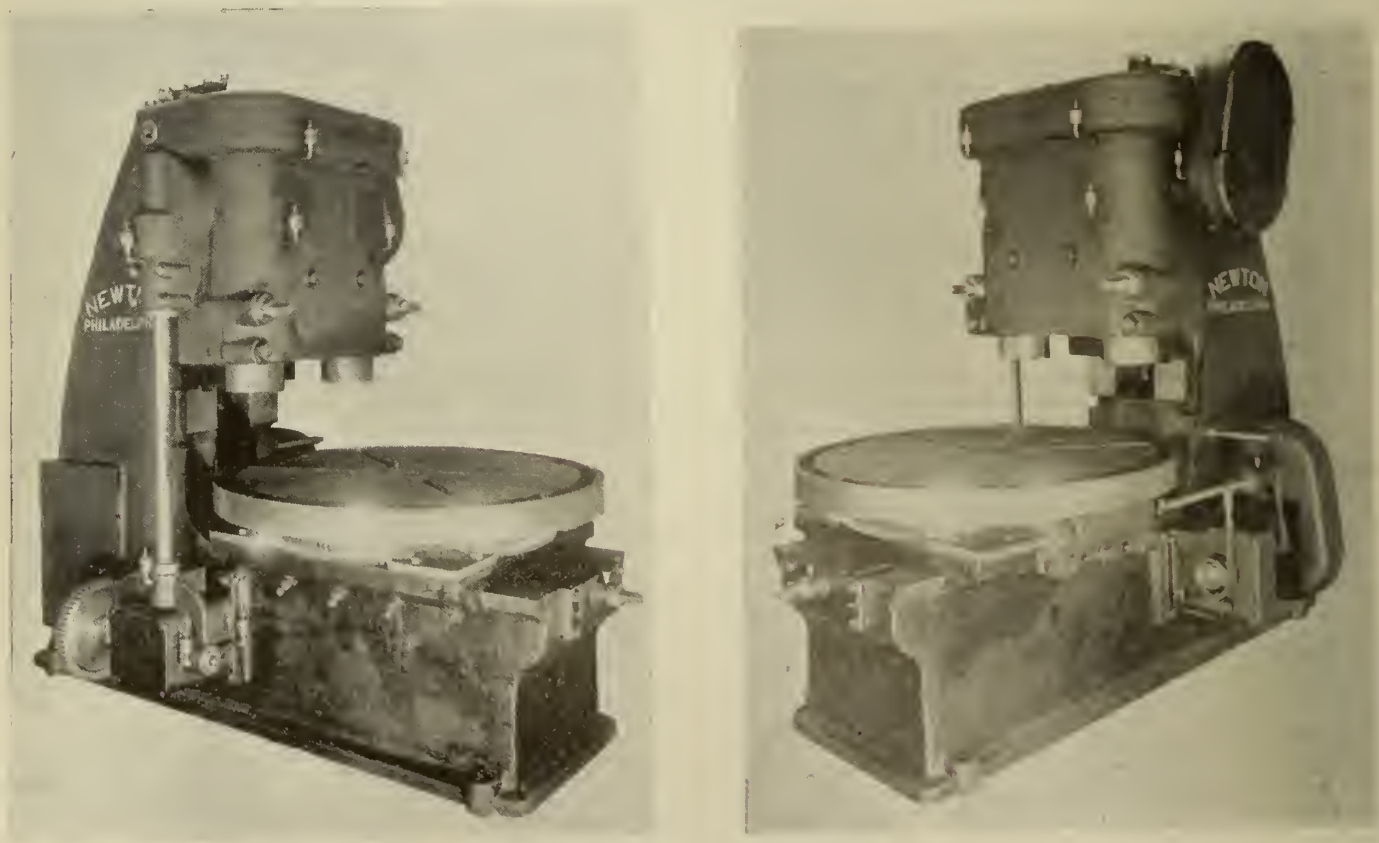


FIG. 4—SKETCHES OF WORK DESCRIBED IN TEXT.



FIGS. 1 AND 2—SHOWING THE MACHINE FROM BOTH SIDES.

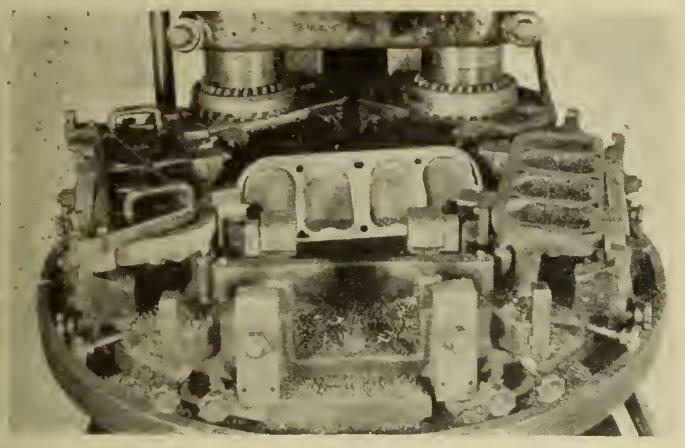


FIG. 3—THIRTY PIECES PER HOUR ARE COMPLETED AT THIS OPERATION.



FIG. 6—MACHINING GEAR CASE COVERS. NOTE FIXTURES USED.

positioning, from the viewpoint that the production is largely controlled by the number of pieces removed to one revolution of the table; hence, it is essential that these be placed with the least possible space between them, whether this space be in the form of an open block, or whether it be in a wedge shaped form, due to the pieces being laid out with too much angularity in relation to each other, and this can only be overcome by having the table adjustable as described. These tables may be 24-inch, 36-inch or 48-inch diameter on their working surface, in addition to which they are surrounded by a pan for draining lubricant when working on steel.

The adjustment to the table provides for the machining of pieces with a flat surface, or machining pieces of a forked character, in which a gang of cutters are used. The rotative movement is controlled by a fixed feed, so that there is no possibility of the operator increasing or decreasing the production of the machine, as any holding device passing the loading station will immediately attract the attention of the man in charge of the section, and in addition to this, as the functions of the machine require so many stations per hour to pass the loading station, that number of pieces must be loaded and unloaded or a clear explanation made as to the loss. There is, however, a provision in the feed mechanism by which this rate of feed can be increased or decreased by those in authority.

The spindle head is equipped with two spindles, each of which is individually adjustable for setting the cutters to gauges. The left-hand spindle is used for the roughing operation, and the right-hand spindle for finishing. The distance between centres of these spindles varies from 22½ inches on the largest machine, to 13 inches on the smallest machine, so that very long pieces can be machined with the roughing operation complete before the finishing cutter starts on the same piece. Demonstration has illustrated that this is perhaps the most accurate method of machining parts in quantities, because any wear or any variation in the machining occurring, due to inequality of castings, is absorbed in the finishing operation, and owing to the small amount of work to be performed by the finishing cutter, accuracy of both finish and dimension are maintained with infrequent grindings of both cutters required, due to this condition. Secondly, with the ability to pick up and obtain accuracy with the finishing spindle, it permits of the running of much higher cutting speeds and feeds than otherwise practical.

The makers state as follows: We have frequently taken pieces 6 inches x 20 inches in length out of the jig and laid them on a surface plate to find that they will hold six papers, and also that it will be impossible to at any point enter a thickness gauge of .0015, indicating that we not only secure a high finish but we do not have any warpage of the casting, or any digging in of the cutter on the leading side. The speeds of the spindles are controlled in the same manner as the feed described above, and a

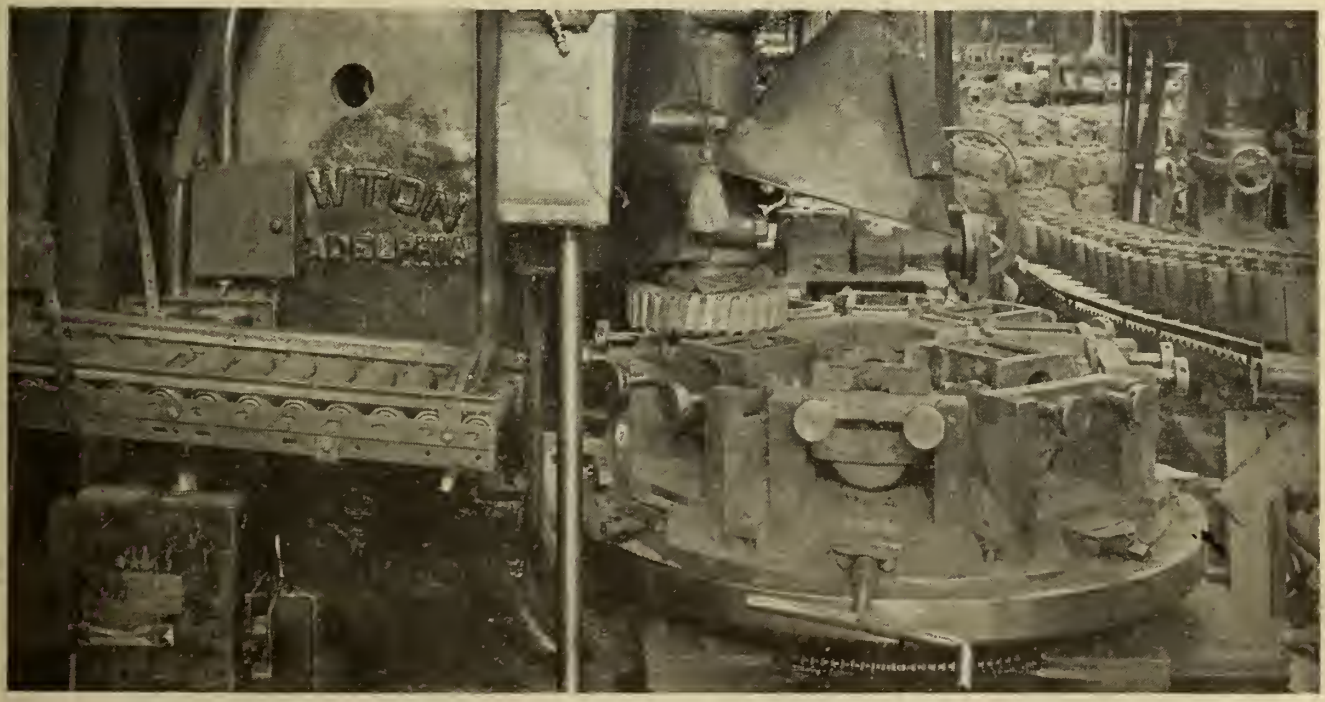


FIG. 7—FIRST OPERATION ON GEAR BOX REFERRED TO AT FIG. 6.

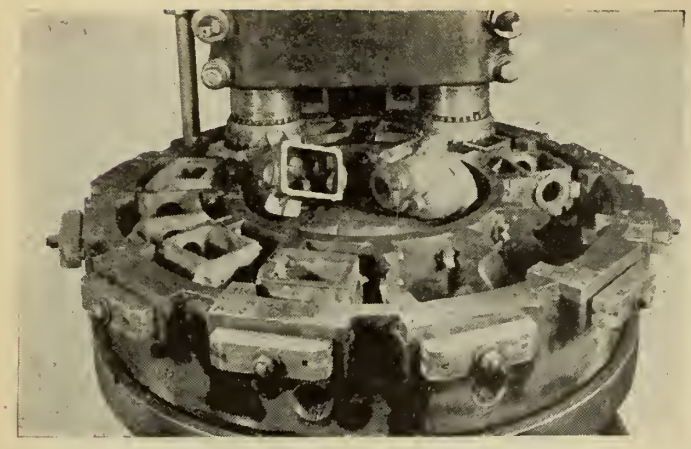


FIG. 9—A BETTER EXAMPLE OF JIG CONSTRUCTION.

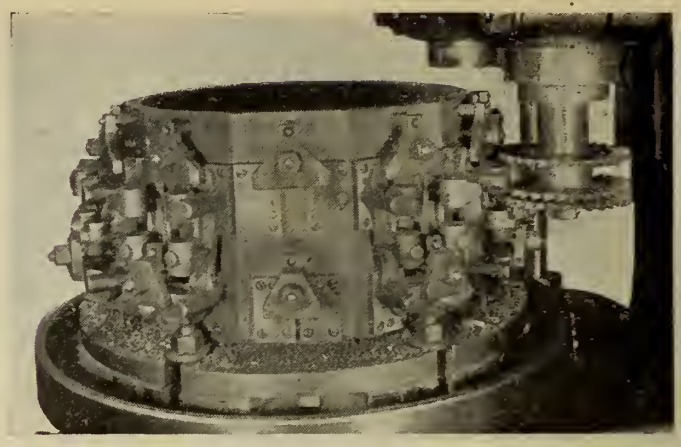


FIG. 10—MACHINING BRACKET AS SHOWN AT "D." SEE FIG. 4.

large element of the success of this work lies in the design of the worms and worm wheels used in the driving of the spindles these worms and wheels being made over a method peculiarly our own, and as the result of very exhaustive experiments carried on in the year 1914.

The housing, or head, carrying the spindles is adjustable on the column, and this again is a necessary element of this type of machine, in order that the holding device may set as flat or low to the table as the casting itself will permit, and the head adjusted downward provides for the minimum extension of overhang to the cutter and spindle; whereas, if this head were a rigid frame having a fixed distance above the table, it would be necessary to build a jig up into the air in order to bring the work to the cutters, instead of bringing the cutters to the work as is done in this design.

One of the big elements entering into the high rates of feeds and speeds that these machines maintain is the manner in which the work presents itself to the cutter. As the work is revolving it will, as you will realize, present a constantly changing angle to the cutter; thereby providing the benefits of the shearing action and overcoming the flat, heavy cutting which is obtained by operations maintained on a straight line.

The machine is made with all driving gears hardened, enclosed and running in oil, with the result that the combined elements of a heavy, rugged frame, exceedingly large bearing surfaces, large diameter spindles, a well balanced drive, providing a surplus of power, means the complete elimination of vibration, and some of these machines have been in operation for several years without having required any replacements or any stoppage other than for changing holding fixtures or cutters.

Fig. 3 illustrates an automobile cylinder head chucked from the rough casting by the gauge appearing in the photograph. In other words, the casting is placed in the holding device, the gauge set in position and the casting then adjusted to the gauge which locks the casting from the combustion chamber, in order that a uniform area of combustion is obtained. The production of these pieces is 30 per hour. The sketch Fig. 4 at A, gives the outline dimensions of these castings. Fig. 5 shows the same casting, and is intended only to illustrate the statement made relative to the angularity of the pieces and the closeness with which they are chucked one to the other. In this instance, owing to the water connection appearing at one end of the casting, it would not be practical, even though the circle were increased, to reduce the space appearing between each casting. Were the casting free of this water connection, then a larger number of pieces on a larger circle would increase the production, because the idle time, as indicated by the gap between the castings, would be omitted.

Fig. 6 illustrates a casting which is a gear case cover or lever stand of an automobile. Observe how closely these pieces come to each other, so that there is no loss of time in the cut leaving and starting from one piece to another. The sketch B, see Fig. 4, shows an outline of this piece, production of which



FIG. 8—THE GEAR BOX AT ITS SECOND OPERATION.

is 120 per hour. Both these illustrations will clearly show the relationship between the size of the cutter and the spindle, so that some comparative idea may be formed of the ruggedness of the entire apparatus.

Fig. 7 shows method of chucking gear box referred to above for the first operation, and Fig. 8 illustrates method of chucking the same gear box for the second operation. The production of these boxes runs from 100 to 125 per hour.

Fig. 9 shows a better construction of jig for a similar piece, which is made of malleable iron, the production of which is 100 per hour, this piece being show at C, in Fig. 4. The photograph Fig. 10 shows method of facing bosses on a bracket. This bracket is shown at D, in Fig. 4, in which you will observe there are six faces to be machined, three of which are on one line, and three on another line, at an angle to the first, so that two operations are required to complete this piece. At a feed of only 4 inches per minute, a production of 30 pieces per hour is provided. Much greater production could be obtained if required. It will be readily understood that it would be quite impossible for one operator to do anything like this amount of work by spot-facing the bearings in place of the process described. These various views are used as typical illustrations of two different classes of work applicable to this type of machine, but they are also used for a variety of other operations, which are too numerous to describe in an article such as the present one.

NEW THINGS IN MACHINE TOOLS

OT-STEEL BENCH LEGS

The Angle Steel Stool Company, of Otsego, Mich., are placing on the market a special line of steel angle bench legs made in various heights and adapted for many purposes. The legs are flat on top and are of pleasing design and where extra width is required the sections may be placed back to back. All legs are finished with a baked-on coat of green enamel.

STATIONARY HEAD DRILLING MACHINE

A heavy-type drilling machine with a stationary head has been developed by the Sibley Machine Company, of South Bend, Ind., which is particularly adapted for production work. Apart from the fixed head the machine is very similar to the sliding head type of the same company. Back gears are of the sliding type and are operated by a lever. Feed change gears run in oil and all gears on the machine are completely enclosed with suitable guards. The machine may be furnished with special equipment if desired. The floor space is approximately 23 by 63 inches.

20-INCH DRILLING MACHINE

The 20-inch drilling machine of the Silver Manufacturing Machine, of Salem, Ohio, has recently been re-designed, the features of reconstruction including a new style of frame and an increased capacity beneath the drill spindle, the maximum distance being now 28 1-4 inches to the base plate. The spindle is fitted with S. K. F. ball thrust bearings. The machine may be obtained with either hand or power feed and can be supplied for both belt and motor drive as desired. The machine is also built in gangs of two, three or four spindles.

HERCULES PRESS-BROACH

The 15-ton arbor press and vertical broaching machine formerly made by the Hercules Machinery Company has recently been redesigned and it is claimed that the number of operations capable of being performed by the new machine has been increased. The operating ram has a stroke of 18 inches and may be driven either by belt or individual motor. The machine is fitted with a knee that has a vertical adjustment of 14 inches, and this knee may be removed and replaced by fixtures or conveyors, if desired. A safety pin is provided for over-load of the press. The travel of the ram is governed by means of an automatic trip.

AUTOMATIC ACETYLENE GENERATOR

An automatic acetylene generator that is primarily intended for use in oxy-acetylene welding, cutting and lead-burning, has been developed by the Imperial Brass Manufacturing Company, of Chicago, Ill. The apparatus is mounted on a truck, making a portable unit. The operation of the generator is automatically started when the gas begins flowing to the torch. The pressure is also under automatic control, and by means of a blow-off is maintained always below 15 pounds. The gas is passed through a water seal as it passed from the generator. Several sizes of the apparatus are manufactured.

NEW TYPE OF GUARD

The Modern Tool Company, of Erie, Pa., are now equipping all their machines with a new type of guard that has the advantage of affording visibility of all the movable parts, at the same time adequately protecting the workmen from coming in contact with any of the mechanism. The guards are of the phantom type and are made of expanded metal and secured to the frame of the machine by means of angle irons. Hinged portions are provided to facilitate the oiling and cleaning of the different parts of the machine protected.

FROM A PURCHASER'S STANDPOINT

(Continued from page 333.)

an advantage. Although the method of locating from the pitch line has given satisfactory results, it is probably just a little less accurate owing to the fact that warpage produced in heat-treatment will have a greater effect at the pitch line than upon the root or at the top of the teeth. Locating the gear from the periphery is open to the objection that greater accuracy is required in the primary operations in order to get satisfactory results. Further difficulties to locating from the periphery arise from the fact that burrs are often thrown up, which, if not removed, will cause errors.

Final Hardening of Gears

All gears made from carburized stock, and, as a rule, all oil-treated gears, are finish-machined before final heat-treatment. Although considerable difficulty may be experienced in the final heat-treating process, the "hump" method developed by Leeds and Northrup Company, Philadelphia, Pa., is one of the most satisfactory of the various methods which may be employed. Distortion in gears is dependent to a large degree upon heating. The range of heating, together with the establishment of constant quenching temperatures, can be relied upon to solve problems in gear distortion which formerly were believed to be uncontrollable. To a large measure the solution of these temperature-control problems is due to the development of the electric furnace.

Methods of Testing Gears

After the purchaser has satisfied himself that the various manufacturing conditions required to produce a satisfactory gear have been complied with, attention should be directed to the final inspection process. The hardness is of much importance, but it should be remembered that tests such as the scleroscope furnishes are comparative only, and that standards of hardness to suit the service to which the gears will be subjected should be established. The limits of these standards should be such that the gear will withstand a reasonable amount of wear, but it should not be so high as to make it brittle. The work of inspection, then, so far as hardness is concerned, is to determine whether the gears are within the limits allowed.

After the hardness test, each piece should receive a rigid visual inspection under good lighting conditions for the purpose of discovering cracks and seams which may develop during the final hardening operation. With reference to inspection of tooth form, a rolling fixture in which the gears are mounted at the correct centre distance and rolled with a master gear is recommended. A hand-rolling fixture will give better results than a power type. The gears should be tested for backlash and for conformity to the dimensions specified by the established practice of the manufacturer.

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British and American Trade

THE extent to which United States producers of steel, finished and semi-finished, have captured the Canadian market can not be appreciated without a study of the figures.

If one cares to go back a few years to 1883 it will be found that the United Kingdom and United States were doing about an equal share of the business of selling steel goods to Canada, there being not more than a couple of hundred thousand dollars' difference in the figures.

But see what has happened in recent years. Taking the figures for the period ending March 31 in each case the years 1913 to 1920 show this:—

Year	Steel Imports From U.K.	Steel Imports From U.S.
1913	$10,394,276.00	$106,471,913.00
1914	10,132,543.00	85,729,001.00
1915	7,402,894.00	55,462,477.00
1916	3,950,000.00	71,459,771.00
1917	4,683,103.00	119,754,365.00
1918	4,081,681.00	154,113,633.00
1919	5,912,768.00	154,426,648.00
1920	5,167,100.00	144,669,402.00

How did this come about? The Canadian Association of British Manufacturers, in a little book published for the purpose of increasing British trade in Canada, points out that there was a great opportunity in 1896 following the coming of preferential tariff treatments in Canada for the British to expand their business here. The article in question points out that "United Kingdom manufacturers never had a better opportunity to capture the now vast trade of this Dominion than that which presented itself in the years immediately following. But what was the result? Most pitiable! Not only did they not hold their established proportion of trade, but by a want of confidence in Canadian integrity, by neglect, by a pursuance of the lines of least resistance, by failure to adequately and substantially support accredited representatives, actually drove the business into the mills of their shrewd and more aggressive competitor."

The result, according to the same source, can be summed up as follows: In 30 years British trade with Canada in steel goods increased 50 per cent., while that of United States increased 1,250 per cent.

American firms have learned the value of publicity in dealing with the Canadian market. Their goods are advertised, and they conform to the wants of this country. British firms have a good opportunity now to study the Canadian market, our ways of buying, the conditions and acceptances on which we finance, and many other things, an observance of which would make a great deal of difference in the trade return figures of months and years to come.

Could You Fill This?

HERE is an advertisement that appeared in a Toronto paper this week. It occupied two inches and carried a heading sufficiently conspicuous to make it noticeable:—

> We have an opening for a man at present as Assistant Superintendent of a large plant in Canada. Desire Canadian, and a technical education would be beneficial, but not absolutely necessary. If you feel you have made good, and your record will stand investigation, it may pay you to get in touch with us. Should have general knowledge of manufacture of mechanical lines. We are looking for a real good man of proven ability, who could take full charge when necessary. No others considered. State experience, age, present connection and approximate salary desired. Negotiations confidential.

Now, these openings keep cropping up now and then. Perhaps not very often, but a glance at the papers shows quite a number in the course of a month.

The position may be offered to-day, or six months from now. That depends on a good many things.

If it were put up to YOU to-day, what would YOU do? Could you walk into the office, make application and state your case, knowing that you would be able to fill the position?

Or would you have to do, as many others, watch that chance go to someone else, and be content to stand back and comment that some chaps had all the luck, and that none of the breaks came your way.

The day of study has not passed, neither has the prospect of dividends for the man who burns the midnight oil.

The openings go to the men who are ready to take them. They seldom wait months or years for a man to get ready.

If you are prepared it may take a long time for the big chance to come, but if you are not prepared, you may take it for granted the big chance will never come.

Guaranteeing the Price

THE practice of cutting rates in piece-work shops is coming to be one of the things that will soon be known only as a memory. It was done in many places. One job comes up from years past of a plow factory where the rate had been set at "so much per" on the polishing operation. Polishing plows is not easy work, at least it was a husky man's calling at that time. When the boys in the polishing room had dusted off enough shares and consumed enough dust to chalk up around $2.25 per day, the new price schedule was posted on the wall, and it became apparent that $1.85 was the limit.

It was another way of punishing a man for working hard.

Under that system the wise piece worker got a job and knew when he was at the limit. He jogged along, killed time and at the end of the day had an output that could be cashed in for $2, or thereabouts. It was encouraging laziness on the part of the men.

All over the country we have shops now where the prices are fixed after a careful study—they are guaranteed for a given period or until such time as there may be an alteration in the operation itself. Production men claim they are getting better results this way than from any other system they have tried.

Must Specialize to Get Mass Production

"THE day of the all-around mechanic is done for with the possible exception of some of the jobbing establishments, and I believe that the change is the best thing for the men themselves and the only possible thing for the shops. The general training still has its place and should not be neglected, but it should only serve as the good groundwork for the development of our specialists."

That, in brief, is the idea of Mr. R. W. Gifford, superintendent of the Massey-Harris Co. plant in Toronto, and what is more, Mr. Gifford can bring out arguments to convince a man that his line of reasoning is right. He is willing to admit, though, that the thorough training is desirable, and that it may be necessary for the shops themselves to bring about a training school of their own in order to keep up the supply of men who shall have a good groundwork from which to draw the specialists and maintenance men of the future.

Where the Move Started

"The specialized shop started with the automobile business," stated Mr. Gifford, in discussing this matter with Canadian Machinery, "and from that it has spread to every other concern that feels the necessity for mass production. There is no other way in which a business can be maintained and face the competition of the world. For instance, I suppose if you were to go into our shops here, and we gave you enough iron or steel, hammers, a fire and anvils or places to work, you could, in time, by sufficient hammering, turn out a plow by yourself, but we couldn't sell it, as there would have been too much cost attached to it, and the time consumed in using all the equipment would also amount to a very great deal.

Nor does Mr. Gifford believe that specializing is a bad thing for the men. "The man who has the all-round training, if he has work that calls for it, can find full scope for every bit of it, but if his occupation calls for another line of specialized work, he may find his previous training a handicap. That may seem a queer statement," continued Mr. Gifford, "but it is a fact that if a plant where production counts for much is looking for a foreman or an executive or a production man, they have to look to these specialized shops now. A shop is no use, neither is its immense equipment, unless that shop is getting production. Now that is the standpoint from which we must start to talk about the specialist from either the angle of the management or of the men. In districts where there are no specialized shops, the manufacturers find that they are handicapped because the men in that district do not understand how to go about it to get mass production."

Even in the Tool Room

Even the sacred precincts of the tool room have been invaded, and in that sphere, where the all-round man was supposed to revel in his wide application of the ways and devices of long training, to-day we have the specialist.

"In the tool room of the Massey-Harris plant," continued Mr. Gifford, "we have some 75 men. We doubled the staff there some time ago, and it may be that we will make large additions to the force there later on. It pays to do it. In that force of tool makers they are nearly all specialists now, and it is hard to see how it could be done otherwise. There is the man working on dies, some on those that are to work on cold metal, others on those that will come in contact with hot metal. Others specialize on jigs and fixtures, some on grinding. What is the result? We get men who we believe are the best to be had on these special jobs, and from these men it is only natural to hold that we get the best work that can be secured."

In Other Lines as Well

That everything is being specialized, and that machinist trade can be no exception, is the view of the superintendent. "Suppose there were something wrong with your eye, to whom would you go to have it fixed, to an ordinary doctor or to a specialist? The specialist, of course, and which one of these men would get the most money for his services? Once more the specialist. When a man goes to college he gets a good training. He may take degrees. But after all that is over, what happens? Does he hang up a sign saying that he has gone through all these subjects and is prepared to give advice on any of them. Not a bit of it—he specializes. He goes in for engineering, for construction, or for any one of many lines. And does it pay us to specialize? Not long ago we finished a die worth over $3,000, but it will save us $15,000. We turned out one die for making seats for agricultural machinery, and out of these seats we punch enough washers to pay for the thing."

How About the Men?

"But where do the men come in on this specializing?" was asked.

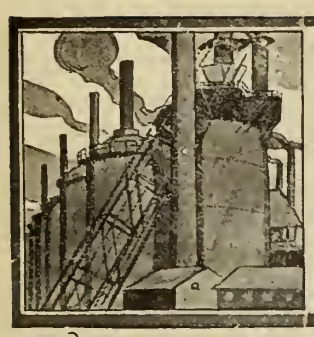
"Guarantee the prices paid in a shop and the men will benefit by the specializing and by the system that will get mass production," replied Mr. Gifford, without any hesitation. "There are plenty of shops where the men have been afraid to let out because they knew that once they reached a certain limit the price on the job would be adjusted so they would have to work harder to get up to their former mark. The result of this policy—a mistaken one, I believe—has been that the full production possibilities of many departments have never been let out. Guarantee the prices, and the same plant will turn out a great deal more work, and it will be better for all concerned."

Mr. Gifford has had a good opportunity to study this point in a number of plants. He can draw on numerous cases to prove his points. "Here is one case that will show the advantage of specializing. One man is in the erecting department, and he has a certain part to bring together. There is a nice little knack in the thing, and he has been at that a long time and can turn out a great deal more work than any other man. He is making more money than a good many tool makers. An all-round mechanic might not make much more than his salt on that job, but the ability of that man to do that little job quickly and thoroughly is a mighty good thing for the man and a good thing for the shop. I can think also of another man on a hammer. He is a specialist on that particular operation. Formerly in that shop they were afraid to pull out because they had a pretty good idea that once they got past a certain limit the price would be cut. The promise was given that the price would stand and the man let loose. There are seasons when he makes four times as much as he used to, and the firm is willing that he should go ahead and make as much more. He specializes on that work and he knows the rate will not be altered. The result is production, and I know of no surer way to get it."

In the Foundry, Too

Mr. Gifford holds that it is possible to specialize all the way through, and it is being done in the foundry. "In our shop out of 150 molders there are probably not more than six or seven general purpose men. The rest are bench, floor men, squeezer, match plate, etc. The use of molding machines tends to this method, and it is the best for all concerned. We do not want a man to work on a dozen things. We want him to do one thing well, and the better he can do it the better will our product be and the more money he will earn. There is one department where shops have not yet got operators in sufficient numbers who are thoroughly adept, and that is in the automatics, especially in operators for automatic screw machines. I do not believe that, as a general thing, the output of this class of machine is much more than fifty per cent. of what the machines are capable of doing. Firms making these machines would find it to their advantage to train operators."

(Continued on page 345)



MARKET DEVELOPMENTS



Steel and Tool Prices Have Not Given Way Yet

Some Few Concessions Being Made, But as a General Thing Conditions Remain Unchanged—Demand for the Delivery of Steel on Order is Just as Insistent as it Was Six Months Ago.

SOME price revisions on machine tools have come out during the week. One maker has announced a schedule that follows the lead of the automobile industry, while the Canadian end of one British firm has given out a revision which makes a few changes, but leaves the list a little higher than previously. New York reports that buyers there feel that the machine tool market belongs to them, and they are reported to be getting some odd concessions that were not available a few months ago. That is about the extent of the price changes, and when taken against the entire field, it is hard to see where much progress has been made in the matter of price reduction.

Men who have covered the field in Canada for steel interests say, that with the possible exception of the automobile business, there is no let-up whatever in the demand for steel, and buyers are just as insistent as ever in wanting to get their orders filled and delivered at their plants. New business is not coming in rapidly to the steel men, this probably being accounted for by the fact that it is not yet possible to get rapid deliveries, although there is a great improvement in this direction.

The departments that specialize in small tools claim that there is more competition going on now than for some months past, and the trade is being thoroughly canvassed in this district to get any business that may be going. Prices, though, remain firm and there is no complaint of any price concessions beyond those generally recognized by the trade.

The scrap metal market shows no change at all. Dealers in most cases state plainly that they can be counted for the present as being out of the market unless there is something offered at quite a price concession. The big users have not returned to the point yet where they will buy, and until that takes place there is going to be continued stagnation.

BUYERS WAIT IN HOPE THAT THE PRICES MAY BE MORE FAVORABLE

Special to Canadian Machinery

MONTREAL, Oct. 7.—Trading conditions are more or less affected by the movement that is becoming general throughout the States and Canada towards an adjustment to lower price levels on many commodities, both industrial and domestic. Business, in consequence, has reflected the conservative policy of consumers, many of whom are adopting a waiting attitude and holding off buying until a decline is announced. It has been stated that increased European production of steel goods has reacted on the Canadian mills and export from here has been on the downward grade.

Lower Prices Anticipated

The trade is undoubtedly facing an early revision of steel prices, but it is difficult to get anyone to commit himself as to the time such adjustment will take place. It is becoming increasingly clear that the demand for finished products is gradually falling off, and with the mills and foundries in a better position to increase production, the result of such conditions can only mean that any change in prices would be in a downward direction. Shipments of American steel are better in volume, and owing to past demand and existing requirements, the greater portion of this material is going direct to the purchaser, but current demand is not adequate to absorb all the steel that is being produced, and with dealers reluctant to stock at present prices, the movement of steels can only continue by removing the barrier of excessive high costs by adjusting the normal level of steel prices to a point where consumers will come into the market with more confidence and assurance of a stabilized condition. It is thought that a concerted effort to lower the cost of steel materials would have a good effect on labor, and remove some of the factors that at present are disturbing many branches of the industry, pave the way for better co-operation between industrial classes, and enable the manufacturing industries to engage in many activities that have been suspended or curtailed owing to the impossible conditions that have intervened.

Metals Quiet But Steady

The movement of metals is of a quiet character but the volume of sales is relatively light, due largely to the conservative attitude of buyers in taking on only sufficient for immediate requirements. The prediction seems to favor lower prices but the existing market is comparatively firm. Lake copper is the only metal showing a change, a decline of one cent, leaving the present quotation at 24 cents per pound.

Supplies Moving Steadily

Coupled with the announcement that business is light, machine tool dealers are living in expectation of lower prices on many of their lines. Many are unable to figure out just how a cut of any magnitude could be reasonably made but admit that this action may take place at any time. The inquiry for equipment is quite light and below normal for this time of the year but the movement of supplies continues in such volume as to indicate that industrial activity is well maintained though easing up in some directions. The better shipments on tools and small equipment reflect a lighter demand, but the cost of production and transportation are still so high that any early drop in prices must be based on trade requirements rather than on manufacturing costs.

Foundry Iron Higher

Apart from steel and cast iron scrap the old material market shows little signs of activity and the general movement of all metals is below normal; as a matter of fact, present business is

duller than it has been for many months. Export of scrap is practically nil and current trading is largely of a local character. The possible downward trend of prices on manufactured products has apparently affected trading, and in consequence the buying of materials has been held up to some extent. The curtailment of production in some industries has likewise been felt in scrap circles and demand is proportionately lighter. The quotations obtaining on all lines are subject to adjustment to suit individual sales but those listed are a fair average of those prevailing in this district. The general situation shows firmness with machine cast iron quoted at $36 per ton, and stove plate at $28, these prices representing an advance of $4 and $1.50 per ton over those of last week.

NOT A REQUEST FOR CANCELLATION

That Is Report of One Machine Tool House — Demand Keeps Up For Steel

TORONTO.—Another week has passed since the talk of price cutting had its start, and still it is hard to find any sign of its striking the machine tool, iron or steel market. Some of the dealers are authorized by their principals to guarantee their prices for some months to come, and in nearly all cases buyers are protected, and they would get the benefit of any reduction that was made.

"We have had no requests for cancellation from any of the business that we have on our books," was the report of one firm to-day. The dealers would be the first to get wind of any such movement in this country, and it would be forwarded from them to the makers. Much of the machinery is sold under the non-cancellation understanding, but the fact that there has been no request for cancellation in any case looks as though there were no doubters in the manufacturing world here. As a matter of fact, as explained by one house to-day, most of the business booked is of a very reliable sort. Very few of the orders are in large lots now, and generally represent changes or additions to existing equipment, and they are not to be upset by any temporary setbacks.

In discussing the matter of prices, the resident representative of a large Old Country firm stated to Machinery that prices had been sent out just a few days ago from the home office. In some cases there was a reduction of a few pounds, and in others an increase. On the whole the prices seemed to have gone up a little. He did not seem to think there was any chance of British houses at present sending in machine tools at a lower figure than they were doing now. "What may take place in the future I don't know, and would not care to predict. There may be a number of influences at work that we know nothing about, and these may have much to do with the prices. For instance, were buying to fall off, or were there many cancellations, the makers might find that they were accumulating stocks, and money is not the easiest thing in the world to secure for getting out finished material right now. It might be that they would have to get rid of some of their stock in order to secure money. In that case it would influence prices. Of course that is entirely suppositious, but I have seen things work out that way before."

The same dealer, when asked regarding the attitude of the buyer in Canada, stated that he did not believe that buyers were holding off in the hope of better prices. A new machine tool, especially of the labor saving variety, would pay its way from the start, and did not depend on the cheese-paring policy in matter of prices.

Hard After Business

Dealers selling small tools report that there is more real business hunting going along now than at any time for months past. "People are getting out to sell at a faster pace than they have been doing for a long time. Many of the stores here have been putting men on small tools and nothing else, and as a result we have to get out more." There is a lot of small business turning up, although there are few large orders coming into the market now. The National Railways have a specification out for a list of carbon drills, but otherwise the business is made up largely of small orders. There is no change in any of the prices."

Little Improvement

In some cases deliveries of steel are not so marked in improvement as they were a week or so ago. A representative of one firm has just returned from going over a good deal of the territory in this district. Speaking of the attitude of the buyers he said, "There is no let-up in the demand for steel. Apart from some of the automobile industries, and other lines that have contracts from them there is the same insistent demand for steel that there has been for months past. I can name a dozen places where I called where my reception was the same. It would run like this, 'Glad to see you, come on in,' and in a very short time it would be around to this, 'You remember that order we had booked with you some time ago? Wish you would take that up and give it your personal attention to see if there is nothing that could be done to get that shipment to us.' Of course there were some variations from that request, but that was the feeling all over. There is certainly no falling off in the demand for steel, apart from the one line to which I referred to at the outset."

The Scrap Metal Market

"We are practically out of the market for the present," is the way one of the large yards stated its position this week. "We have been expecting the turn to come for some time, and believe that a day one way or the other is going to make the difference. If the market remains weak now for a few days longer, or if it breaks, I believe that there will be business resumed, but it will be on a lower plane than we have been used to."

The unsettled conditions following the price cutting move seems to have something to do with the scrap market. Many of the users are continuing to draw on reserves, believing that they

POINTS IN WEEK'S MARKETING NOTES

Pittsburgh reports that not very much progress has been made toward low prices for steel, though it admits that the general sentiment has become much stronger on this subject.

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The cancellations that have come, through the automobile makers to the steel mills, released a tonnage that has been taken up by other industries.

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Information from Pittsburgh for steel at fairly quick delivery is quoted this week at 3 cents for bars, 3.10 cents for shapes, and 3.25 cents for plates. Some predictions are that these prices will yield, but there is no evidence of it yet.

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There is very little attention paid to lower prices talk in the machine tool market, although there are reports of one maker having issued a new price list.

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One of the largest machine tool houses in this district reports this week that so far they have not had a single appeal for cancellation of any business on their books.

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One Old Country house doing business in Canada has forwarded new lists on machine tools. Some of these show increases, others are down a little, but as a general thing the whole list is said to be a little upward.

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Some of the small tool dealers report that there is more competition at the present time in the Toronto field than there has been for a good many months past.

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The scrap metal market is waiting for a turn that will bring some business its way. Some of the largest yards state frankly that for the present at least they are out of the market. The large users are not buying, and dealers show no tendency to take on material for stock.

will be able to make replacements at a lower figure. It all tends to keep the buyers out of the market and the dealers do not feel as though they would be justified in going ahead and buying for stock.

TOOL MARKET IS THE BUYER'S NOW

New York Looks For a Quiet Period For the Remainder of the Year

NEW YORK, Oct. 7. — The recent trend of price developments points to rather quiet conditions in the machine-tool trade over the remainder of the year at least. This is a buyer's market, and it is but natural that buyers should be considering the possibility of lower prices on all of the products they buy, including machine tools. As yet there are no indications of a downward movement in machinery prices, but concessions are being made by sellers that were not necessary a few months ago. For example, some sellers, at the request of buyers, are guaranteeing their prices for a period of three to six months.

While the outlook for the remainder of the year in the machine-tool trade is for very light buying there is a deal of optimism as to next year's prospects. The railroads are expected to come into the market eventually, and some sellers have fixed the beginning of substantial railroad buying as about January 1. Railroads are known to be working on budgets for 1921, and if the financial situation warrants it is believed likely that they will buy quite heavily of shop equipment, which they are known to need very badly. Some of the railroad shops are antiquated, and a considerable part of the shop equipment of some of them is in a bad state of disrepair. It would seem as if buying of machine tools for the railroad shop cannot much longer be deferred.

At present, however, there is practically no railroad buying in the East, though a number of roads have made fairly good purchases at Chicago.

BRITISH PRICES ON THE WAY DOWN?

Galvanized Sheets Show a Definite Rrop of $7 Per Ton For Export

British prices show a downward tendency, particularly for export. A definite drop of $7 per ton is noted in galvanized sheets, which are now about 6c a pound at to-day's rate of exchange.

A wide divergence in wages is indicated in puddling. The current British puddling rate, expressed in American money, is $8.25 per ton, while the last settlement at Youngstown, Ohio, established a rate of $18.02 for September and October.

AUTO CANCELLATION NOT GOING TO BATTER DOWN STEEL SCHEDULE

(Special to Canadian Machinery)

PITTSBURGH, Oct. 7.—In itself, the iron and steel market shows very little by way of new developments and not much progress has been made, visibly, towards lower prices. General sentiment, however, has become much stronger on the subject of substantial price declines being necessary. Undoubtedly the declines in automobile prices have had a great deal to do with molding public opinion as to prices generally. It seems that the public takes particular interest in whatever occurs in the automobile field. In last report it was noted that Ford, Franklin and Crow-Elkhart, had reduced prices. To the list may now be added Locomobile, Studebaker, Mercer and Overland. One may well conclude that a general and substantial decline in automobile prices is in progress, no matter what technical denials individual automobile makers may give to the press. The reductions are not sporadic, the names on the list of reductions thus far being typical of altogether too many classes of machines. Locomobile, Franklin, Studebaker and Overland each fall in a different class.

Steel and Automobile Prices

The steel industry is quick to refuse to admit that steel price declines can be connected with automobile price declines. It is commonly admitted in the steel trade that steel price declines must occur, the common view being that independent prices will recede to the Steel Corporation level, whether in a few weeks or a few months, and it is also the common view that the Steel Corporation prices will not be reduced. Some independents may have to cut under Steel Corporation prices to regain trade lost by what some buyers have not hesitated to call profiteering practices. The steel trade wants it to be understood, however, that the automobile trade itself cannot force down steel prices. It is admitted that the automobile trade was in large part responsible for the particularly fancy prices for prompt deliveries of steel that obtained early in the year, but it is asserted that the trade's power to put prices down is by no means measured by its influence in putting prices up earlier in the year, when automobile and part makers bid for prompt deliveries when the mills had already sold their product.

As to possible declines in Steel Corporation prices an impressive comparison is made, showing that from the Steel Corporation's standpoint automobile makers can have no argument that since they have reduced their prices the Steel Corporation should reduce its prices. The comparison takes an automobile that has been selling at between $2.000 and $3.000. The reduction in price on this movement might be $150, or $300, or even $400. Less than one gross ton of rolled steel, in the form in which the average steel mill sells steel, is represented in that automobile. The Steel Corporation's rated capacity is 16,200,000 tons a year, of products weighed in the form in which sold. A fair production can be taken at not under 15,000,000 tons. The common shares outstanding amount to about $508,000,000, so that $15,000,000 would represent $1 a ton on a year's output and would also represent a three per cent. dividend. The corporation certainly would not reduce prices to the automobile trade and keep them up to the railroads, to investors putting up bridges, buildings, etc., and to other buyers, hence a horizontal reduction in all prices is the only thing that could be considered. A reduction, therefore, that would be equal to a three per cent. common stock dividend would amount to less than $1 in the mill cost of the steel entering into a $2,000 or $3,000 automobile. In other words, the steel mills cannot help the automobile trade to recoup when it reduces prices of automobiles.

Another item that dissociates the automobile price reductions from the steel market as it is made from day to day and week to week is that the automobile trade is not in position to offer orders of any consequence at this time. Many of the automobile makers have contracts running to the end of this year, with the prospect that on account of reduced consumption deliveries will run into the new year. General Motors is commonly understood to have a contract running through next June, covering considerable parts at least of the requirements of its various subsidiaries. If there is such a contract it is with the Steel Corporation and at the Industrial Board prices, since the corporation has sold to domestic trade at no other prices since the schedule became effective March 21, 1919, and an automobile manufacturer can hardly complain about Industrial Board prices.

Two Steel Markets

There used to be three steel markets, the Steel Corporation set of prices, a schedule of prices, not entirely definite, at which certain large independents were selling to regular trade for extended delivery, and a wide range of prices representing prompt deliveries, charged chiefly by smaller mills that kept their order books relatively clear. The last named market has now practically disappeared. One can, as a rule, secure rather prompt deliveries at the prices formerly ruling only for somewhat extended or delayed deliveries. That market is substantially unchanged. It is represented by 3c for bars, 3.10c for shapes and 3.25c for plates. In time these prices will doubtless yield, but there is no distinct evidence that they have yielded thus far.

Last week the American Pig Iron As-

sociation, composed of merchant furnacemen from a majority of the producing districts, held its monthly meeting at the William Penn Hotel, Pittsburgh. The prevailing, practically the unanimous, sentiment at the meeting, derived from information obtained from customers, was that a general industrial depression is impending, to exhibit its full force in the first quarter of the new year, with greatly reduced consumption and production and materially altered pig iron prices. The atmosphere of that meeting was as different as can be imagined from that of the meeting two months earlier, when several furnacemen were loudly predicting "pig iron is going to $50." It did go to that figure, in the case of foundry iron valley, Cleveland, Buffalo and Eastern Pennsylvania, but apparently the advance occurred chiefly because the furnacemen set out to get it. The furnacemen did not, however, get the orders. That was another matter. Consumers stopped buying. The trade has it that foundry iron at valley and Cleveland furnaces has now declined $3, to $47, furnace, but the decline rests upon even flimsier foundation than the preceding advance, as there was simply a small sale by a middle interest. No one doubts, however, that a buyer with an attractive inquiry could buy foundry iron at $47. The buyers do not want to pay that price and do not know what price they would pay. They are in position to wait until conditions become clearer.

PROSPECTS GOOD IN THE EAST NOW

Steel Mills Run at Capacity, and Output of Coal is More Satisfactory

Montreal.—Roy M. Wolvin, president of the Dominion Steel Corporation, left for Cape Breton to inspect the Sydney steel plant and the Cape Breton coal fields. From there Mr. Wolvin will proceed to Newfoundland, where he will make a tour of inspection of the corporation's mines at Wabana.

Reports from Sydney, Mr. Wolvin stated prior to his departure, were most encouraging, the steel mills there working to capacity, with the production at the coal mines showing a gratifying increase over previous levels, the output for September being particularly satisfying, although definite figures for the month had not yet been received at the Montreal office.

Mr. Wolvin's visit to the Wabana mines is in connection with the resumption of the export trade in iron ore, which during the war period and since the armistice, was reduced to negligible proportions. Mr. Wolvin states that it was hoped that the advent of 1921 would see a profitable trade in ore again established. the new overseas connections formed through the British Empire Steel Corporation being an important factor in the market for the ore.

PIG IRON TRADE

The iron market is developing soft spots. Valley foundry iron sold this year at $47 base. Basic is being offered at a lower rate by steel makers than the regular sellers. The prices are uncertain as there are few sales. Resale is the main feature of the pig iron market in Philadelphia. Very little interest is shown in next year's iron.

The market at Chicago is strong 1.75 to 2.25 silicon sold at $46 furnace. No iron is being piled, delivery being equal to production.

It is reported in Cleveland that basic could be had at $46.50 valley. The demand from stove foundries is unusually heavy, especially from the hot air furnace men.

The pig iron situation in New England has resolved into a struggle between consumers and furnaces to see which can hold out the longer.

The foundrymen almost without exception believe that the prices are going to drop, and refuse to buy beyond their immediate requirements. Eastern furnaces feel there is much uncertainty as to the future market. Requests have been received urging deliveries. New business has been small on the New York market during the past week. Prices remain unchanged for next year. Basic is wanted to some extent.

Owing to the feeling that prices are about to decline, consumers of pig iron are staying out of the Pittsburgh market. The foundry market shows a sagging owing to a sale last week of 700 tons of No. 2 foundry iron (1.75 to 2.25 silicon) to an Ohio consumer for last quarter delivery at $47 valley furnace.

No apprehension has been caused among Southern pig iron producers by the lull in the market. $42 for No. 2 foundry (1.75 to 2.25 silicon) is still the base. A few new inquiries are coming in but sales are very limited.

U.S. SCRAP METAL

Prices in the U.S. scrap market are declining slowly. Dealers are doing some buying, but consumers have reserves and are waiting for lower levels, refusing to be interested. On the Chicago market the consumers feel they can safely work on their reserves and expect to buy at a lower rate when forced into the market later.

The market in steel scrap shows weakness in New York, and though reductions have been made, demand is dull.

Dealers in the scrap market in Philadelphia attribute the present lull in the scrap market to the influence of price reductions in automobiles made by the Ford Motor Co. Shipments on contracts continue heavy.

Prices in all grades have declined in Boston. Dealers are unable to place tonnage except by making heavy concessions.

Practically no inquiries are being made for iron and steel scrap in Pittsburgh. Consumers are comfortably supplied. Prices are unchanged.

Many Buffalo dealers are anxious to obtain material to cover orders taken in the last month, but are holding back hoping for a break in the market. Lower prices are regarded as inevitable.

On the Cincinnati market, iron and steel scrap shows a lagging tendency, but some good orders for future delivery have been made and enquiries continue. Heavy shipments of recent purchases are being made.

BALDWIN PLANT STARTS ROLLING

The Tin Plate Mill Had Its First Trial Run a Few Days Ago

Baldwin's new $2,000,000 plant at Ashbridge's Bay has commenced rolling tinplate. Mrs. H. A. Cooch of Toronto at the opening threw the switch and the huge 1,500 horsepower electric motor set in motion the tremendous 160-ton main rope drive wheel, the largest flywheel yet used in Canada. The battery of eight mills commenced to grind. Then, cheered by hundreds of watching workmen, Toronto society women fed plates of white hot steel into the mills and rolled them again and again.

Mrs. A. M. Russel, wife of the president of the company, rolled the first sheet in No. 3 finishing mill. Other women who demonstrated their ability as steel workers were: Mrs. Roy Miller, Mrs. Fred Miller, Mrs. E. L. Cousins, Mrs. H. A. Cooch and Miss Church. Controller Maguire rolled the first plate through the roughing mills.

MUST SPECIALIZE

(Continued from page 341)

The whole shop organization is rapidly changing, and there should be a change in the training of men for the mechanical field to keep pace with the times. Mr. Gifford does not believe that the man who wants to be a success should think any the less of the fundamental training he needs. "Don't think that I am opposed to having the well-trained man. Every shop should see to it that an apprentice gets a thorough grasp of the fundamentals, and shops are not paying enough attention to this matter. We need these men, need them for maintenance, need them all the time to develop into branches that are almost passing out for want of well-trained men. Just one class need be mentioned, viz., the die-maker, and the real die-maker is becoming almost an extinct species."

Mr. Gifford has no apologies to make for the specialized shop. He firmly believes that it is the only way to secure results, and he is convinced that it is the best thing for the men and the best thing for the large industries—in fact he can see no other way in which they can be carried along successfully.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 75
Steel bars, base, Toronto	5 75
Iron bars, base, Montreal	5 75
Steel bars, base, Montreal	5 75
Reinforcing bars, base	5 75
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 10
Chequered floor plate, 3-16 in.	8 50
Chequered floor plate, ¼ in.	8 10
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	5 75
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 67 to 5 50
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58½	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

METALS

	Gross. Montreal	Toronto
Lake copper	$24 00	$23 50
Electric copper	24 00	24 00
Castings, copper	23 50	24 00
Tin	54 00	55 00
Spelter	9 00	10 50
Lead	9 50	9 50
Antimony	9 50	12 00
Aluminum	36 00	37 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 35
Plates, ¼ up	6 50	6 60

PIPE—WROUGHT

Standard Buttweld Pipe

Per 100 Ft.

	Steel		Gen. Wrought Iron	
	Blk	Galv.	Blk.	Galv.
⅛	$ 6 50	$ 8 50	$.....	$.....
¼	5 31	7 41	5 91	8 01
⅜	5 31	7 41	5 91	8 01
½	7 10	8 63	7 95	9 18
¾	8 86	10 87	9 95	12 02
1	13 01	16 07	14 71	17 77
1¼	17 60	21 74	19 90	24 04
1½	21 04	25 99	23 79	28 74
2	28 31	34 97	32 01	38 67
2½	44 75	55 28	....	....
3	58 52	72 29	....	....
3½	74 06	90 62	....	....
4	87 75	107 37	....	....

Standard Lapweld Pipe

Per 100 Ft.

	Steel		Gen. Wrought Iron	
	Blk.	Galv.	Blk.	Galv.
2	$32 01	$ 38 67	$35 71	$42 37
2½	48 26	58 79	54 11	64 64
3	63 11	76 88	70 76	84 53
3½	75 90	92 46	85 10	101 66
4	89 93	107 55	100 83	120 45
4½	1 05	1 29	1 30	1 54
5	1 22	1 50	1 52	1 80
6	1 58	1 95	1 97	2 33
7	2 06	2 53	2 53	3 01
8L	2 16	2 66	2 66	3 16
8	2 49	3 07	3 07	3 64
9	2 98	3 67	3 67	4 36
10L	2 77	3 41	3 41	4 05
10	3 56	4 39	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger, 50%.
4" and under, running thread, 30%.
Standard couplings, 4-in. and under, 30%.
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	17 00	17 00
New brass cuttings	11 00	11 75
Red brass turnings	14 50	15 75
Yellow brass turninbs	9 00	9 50
Light brass	7 00	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 50	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	Gross
Heavy melting steel	20 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	30 00	20 00
Rails (scrap	23 00	18 00
Malleable scrap	26 00	25 00
No. 1 machine cast iron	36 00	33 00
Pipe, wrought	12 00	12 00
Car wheel	33 00	33 00
Steel axles	25 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	28 00	25 00
Cast boring	14 00	14 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	+10
Carriage bolts, ⅜-in. and less	Net
Coach and lag screws	—15
Stove bolts	55
Wrought washers	—25
Elevator bolts	+10
Machine bolts, 7-16 and over	+10
Machine bolts, ⅜-in. and less	+10
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 50
Nuts, hex., tapped	add 3 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	—20% 25 and 5
Sq. and hex. hd. cap screws	12½
Rd. and fil. hd. cap screws	plus 25
Flat but. hd. cap screws	plus 50
Fin. and semi-fin. nuts up to 1-in.	12½
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	—5
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	+12½
Studs	+5
Taper pins	—12½
Coupling bolts	+40
Planer head bolts, without fillet, list	+45
Planer head bolts, with fillet, list plus 10 and	+55
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	+60
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add +85
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails, base	$6 10
Cut nails, base	7 00
Miscellaneous wire nails	50%

ROPE AND PACKINGS

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

LeBLOND
HEAVY DUTY
Universal Millers

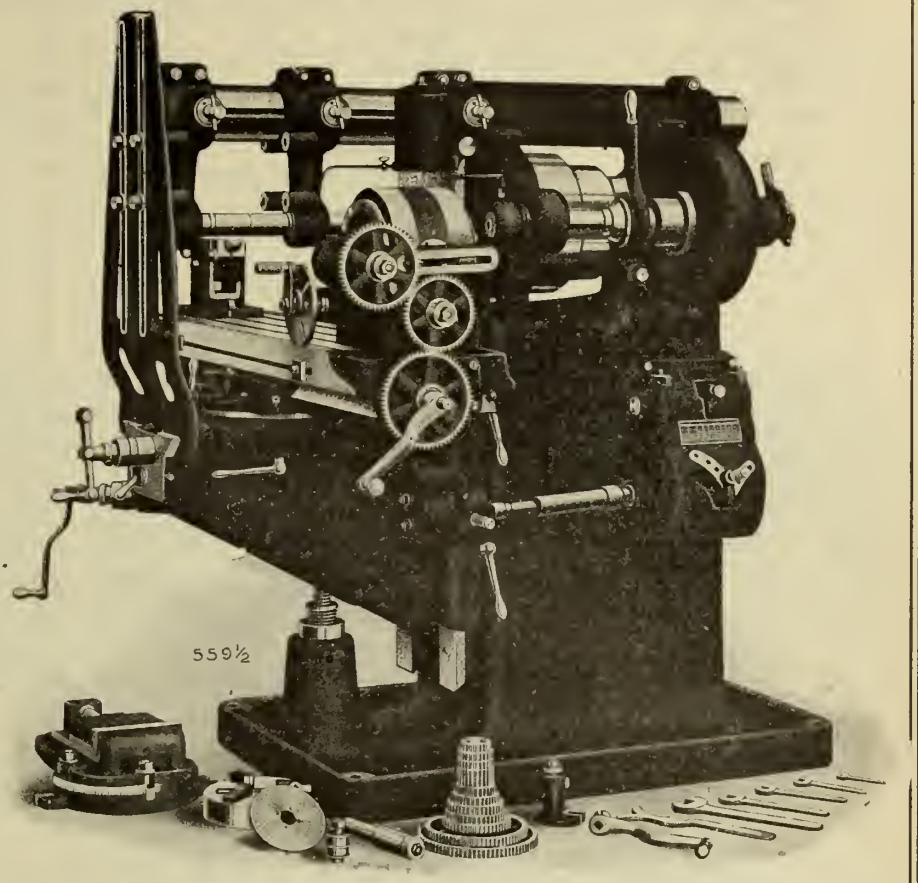
Are not only Tool Room Machines, but as a manufacturing proposition appeal to the careful buyer.

Their long life insures ample returns for the investment made.

May we explain to you their many advantages and the convenience of their control.

Carried in stock by

The A. R. Williams Machinery Co.
LIMITED
TORONTO



AGENTS WANTED

For a high grade Piston Packing amongst mill and steamer supply houses in all the principal centres. Sold at a reasonable price, allowing for a good margin of profit to the dealer.



Write for our agent's proposition

Guildford & Sons, Limited

Office and Warehouse:
136-140 Upper Water St.
649-651 Barrington St.

Factory, June St.
HALIFAX, N.S.



MISCELLANEOUS

Solder, strictly	$ 0 35
Solder, guaranteed	0 39
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	20 35
Red dry lead, 100-lb. kegs, per cwt.	16 00
Gasoline, per gal., bulk	0 38
Pure turp., single bbls., gal.	3 15
Linseed oil, raw, single bbls.	2 37
Linseed oil, boiled, single bbls.	2 40
Wood alcohol, per gal.	4 00
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	10 to 30
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	70	85
Class B	30	40
Class C	20	30

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$12 00	12 10
Sheets, Blue ann., No. 10	9 50	9 60
Canada plates, dull, 52 sheets	13 00	13 00
Can. plates, all bright	14 00	.....
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	13 50	.....
Fleur-de-Lis, 28 B.W.G.	13 00	.....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	12 60
Premier, 10¾ oz.	11 50	13 00
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅝ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	35 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	27½
Palacine	30½
Machine oil, per gal.	54½
Black oil, per gal.	28
Cylinder oil, Capital	82½
Petroleum fuel oil, bbls., net	18

BELTING—No 1 OAK TANNED

Extra heavy, single and double	6½
Standard	6½
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	11
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	.24
Peerless	.22½
Grand	.22½
Superior	.22½
X L C R	.21
Atlas	.20
X Empire	.19½
Ideal	.19
X Press	.17½

Colored

Lion	.17
Standard	.15
No. 1	.15
Popular	.13
Keen	.11

Wool Packing

Arrow	.35
Axle	.28
Anvil	.22
Anchor	.17

Washed Wipers

Select White	.20
Mixed colored	.10
Dark colored	.09

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	49 00	48 00
Copper sheet, tinned, 14x60, 14 oz.	52 00	48 00
Copper sheet, planished, 16 oz. base	56 00	55 00
Braziers', in sheets, 6 x 4 base	48 00	46 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$11 50	$14 50
Sheets, 3½ lbs. sq. ft.	11 25	14 00
Sheets, 4 to 6 lbs. sq. ft.	11 00	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.04
Acid, nitric	.11
Acid, sulphuric	.04
Ammonia, aqua	.15
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy	.41
Copper, sulphate	.15
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.20
Nickel carbonate	.32
Nickel sulphate	.22
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.30
Silver nitrate (per oz.)	1.25
Sodium bisulphate	.14
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.10

Prices per lb. unless otherwise stated

THE WORLD CALLS

NEVER BEFORE, AS NOW, HAS THE WHOLE WORLD CALLED

"PRODUCTION"

Are you doing any Screw Thread Cutting?

How are you doing it?

Do you know that Geometric Thread Cutting Tools have effected an enormous saving of time and costs in many thousand shops?

The first step is to investigate. Tell us the job you have to do, and hear what we can do for you.



THE FINAL SHIPMENT OF THE DAY---*THE FREIGHT SHIPMENT*

Express -- Parcel Post -- Mail -- Freight

These are the four channels by which Geometric Screw Thread Cutting Tools and Machines are shipped.

There is no place where more business is done to the square foot than in our Shipping Department, because of the demand for Production Tools—Automatic Die Heads and Collapsing Taps—everything for more and better screw threads.

Make Screw Thread Cutting the Most Satisfactory Operation in Your Shop.

——Write——

THE GEOMETRIC TOOL COMPANY

NEW HAVEN CONNECTICUT

Canadian Agents:

Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg, St. John, N.B., Halifax, N.S.

Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

British Trade Fairs Have Been Planned for 1921

Attendance Restricted to Bona Fide Trade Buyers—Only British Manufacturing Firms Are Allowed to Exhibit—List of Lines to Be Allowed at the Various 1921 Exhibitions.

THE three fairs, although held in different cities (London, Glasgow, and Birmingham), are, in reality, only sections of one fair, and together constitute the greatest trade fair in the world.

The London Fair is directly organized by the Imperial Department of Overseas Trade on behalf of the British Board of Trade, while the fairs in Birmingham and Glasgow are organized by the municipalities of the respective cities under the auspices and with the support of the British Board of Trade. An important point in the organization of the three fairs is that they are held practically concurrently, and that each fair represents a specified group of industries. No industry is permitted to exhibit at two fairs, and consequently the buyer knows that at whichever fair he may be visiting he will find the whole range of exhibitors in any particular trade or trades. Further, by careful arrangement of the dates of the sections it is made easy for him to visit all three should he wish to do so, for while the London and Birmingham fairs run concurrently from the 21st February to the 4th March, the Glasgow exhibit opens a week later, on the 28th February.

The British Industries Fairs are not exhibitions. They are trade fairs, to which admittance is restricted to bona fide trade buyers seriously interested in the participating trades. Only British manufacturing firms are allowed to exhibit, and no exhibitor is permitted to exhibit goods other than those of his actual manufacture. The result is that buyers who visit the fair know that no articles shown on an exhibitor's stand can be purchased elsewhere in the fair. Exhibitors are also able to give proper attention to the buyer, and the buyer is able to do his business unhampered by crowds of sightseers.

The following articles will be exhibited in London (February 21 to March 4):

Fancy Goods, Including Travelling Requisites and Tobacconists' Sundries

Leather for fancy goods, bookbinding and upholstery trades; brushware; paper, stationery and stationers' sundries; printing; toys, games and sports goods; cutlery, silverware and electro-plate; imitation jewellery and hard haberdashery; jewellery; watches and clocks; spectacle ware; scientific and optical instruments; glass and glassware; china and earthenware; drugs and druggists' sundries; furniture; basketware and cane furniture; musical instruments.

In Glasgow (February 28th to March 11th) the sections are: Textiles of all descriptions; ready-made clothing, including hosiery; hats and caps; boots, shoes and gloves; carpet and upholstery materials; foodstuffs (prepared and preserved) and beverages; chemicals (light and heavy); domestic chemical products.

The Birmingham (February 21st to March 4th) sections are: Brassfoundry of all kinds; hand tools and tools for use on machinery; hollow-ware; cooking and heating stoves; mechanical rubber goods; tubes and fittings of copper, lead, brass, steel, etc.; non-ferrous metals and alloys in all forms, such as ingots, sheets, rods, wire, etc.; metallic bedsteads; metal furniture for office, shop, garden and camp; sanitary metal-ware and earthenware; architectural and ornamental metalwork; scales, balances, etc., and measuring appliances; general hardware of all descriptions, including nails, locks, domestic utensils, etc.; perambulators, mailcarts, pushcarts, etc.; firearms and fishing tackle; machinery belting; cycles and motor-cycles; accessories for cycles, motor-cycles, cars and aeroplanes; paints, colors, varnishes, etc.; ropes (wire and fibre); saddlery and harness, and metal furniture for same.

Buyers from the Dominion who wish to visit the fair should apply as early as possible to the nearest British Trade Commissioner, from whom they will be able to secure full information. Their names and addresses are:

Captain E. J. Edwards, H.M. Senior Trade Commissioner, 248 St. James Street, Montreal.

F. W. Field, H.M. Trade Commissioner, 260 Corporation Life Building, Toronto.

L. B. Beale, H.M. Trade Commissioner, 610 Electric Chambers, Winnipeg, Manitoba.

On their arrival in England it would be to their advantage to communicate at once with the secretary, British Industries Fair, 35 Old Queen Street, London, S.W.1, England, or, should the fair have commenced, at the White City, Shepherd's Bush, London W.14, England.

Full details of the Birmingham Fair may be obtained on application to the General Manager, British Industrial Fair, Chamber of Commerce, 95 New Street, Birmingham, England.

For the Glasgow Fair, enquiries should be addressed to J. M. Freer, Esq., Kelvin Hall, Glasgow, Scotland.

BRINGS OUT A SAFETY MASK

Stratford Man's Idea Has Been Approved of by Several Associations

Stratford.—An invention by J. Welsby, 17 St. Vincent Street, has just been made known. It is a protector for the face for iron and steel polishers. It is a mask which fits over the face, and is in the form of a screen. Iron wires run across and copper wires up and down. These are magnetized, and to them all minute particles of steel are attracted, and thus kept from entering the eyes. The invention has been endorsed by the National Safety Association of Chicago, and will be endorsed, it is said, by the International Metal Polishers' Association of Canada.

PLANTS NEED MORE POWER TO OPERATE

Chairman Elliott, of the Civic Utilities Commission of Kingston, and other officials state that the power situation there is very serious, and that unless conditions speedily improve the supply of power to the city may be decidedly curtailed, if not indeed entirely shut off. So serious was the situation this morning that the Hydro-electric officials were in almost constant telephonic communication with the local officials as to the continuance of the power supply.

From what can be learned the present difficulty is due to the very low water in the Trent River, and the only way it can be relieved is by a greater flow of water there, which can be obtained by lowering the level of Rice and Stony Lakes, which flow into the Trent River, by at least one and a half feet. If this is not done, it is declared, the industrial power situation in all central Ontario, as well as here, will be seriously threatened.

Peterboro' Also Suffering

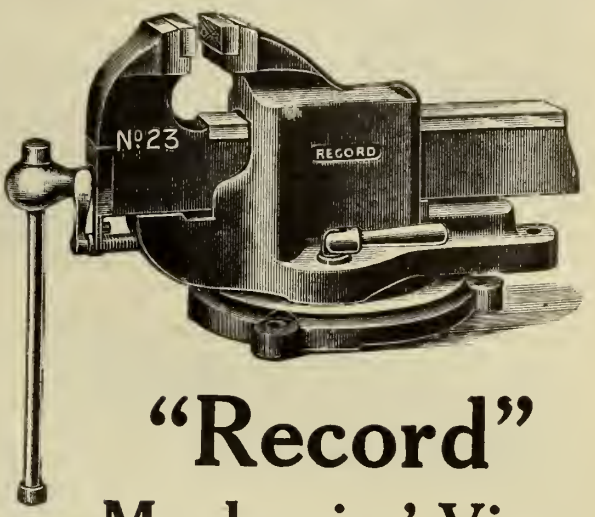
Peterboro' city and district is suffering from a power shortage, due to low water in the Otonabee and Trent Rivers. A deputation representing the city council and board of trade went to Ottawa to present to the Department of Railways and Canals the temporary necessity of an increased flow of water through the Trent waterway. The deputation will ask for a suspension of the Canal Department's regulations that provide for a certain height of water until the navigation season ends. Local manufacturers find it difficult to keep their plants running to the limit, owing to the power shortage, which usually becomes more serious in the afternoons of each day.

Such is the scarcity of electric power at present in the Belleville district owing to lack of rain that most of the industrial plants are being shut down in turn to eke out the supply. Rains alone can help the situation.

Aikenhead's

Canada's Leading Tool Supply House

"Everything in Tools" is our motto, and we live up to it. From our large stocks we are at all times able to fill your requirements promptly. This ability and our efficient, courteous service has won for Aikenhead's the appellation of, **Canada's Leading Supply House."**



"Record" Mechanics' Vises

"Record" Mechanics' Vises are strong, reliable tools. They offer you the opportunity of securing high-grade English Vises at remarkably low prices. Send for price list!

No. 23 Quick-Acting Vise. Can be furnished with either stationary or swivel base. The quick-grip feature is a great time-saver. If you need a good vise, here is your opportunity.

No. 4 Plain Screw Type Vise. A tool for really hard work. Made of the best grey iron castings. We can supply this vise with stationary base only.



Wahlstrom

Self-Centering, Automatic Drill Chucks

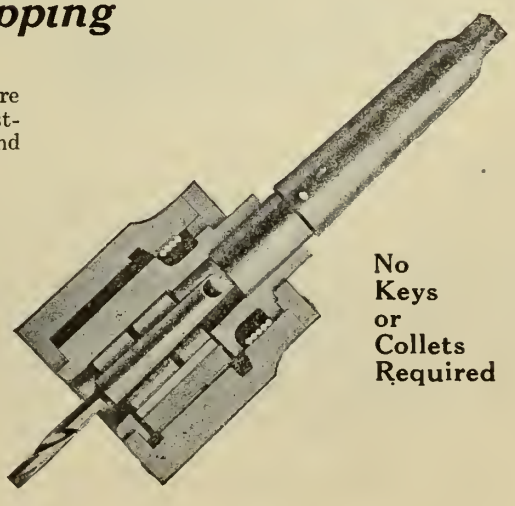
Holds Drills Without Slipping

The instant-acting jaws of the Wahlstrom close on the entire shank with a grip that becomes firmer and firmer as the resistance to the tool increases. The clutch positively cannot slip and the jaws never mark a tool.

With a Wahlstrom, two seconds is all you need to change the operation from drilling to reaming, counterboring, or tapping—and you don't stop the spindle; simply grasp the chuck with one hand and replace the loosened tool with another. Just think of the time this will save you!

Made in two different styles. One style holds No. 1, 2 or 3 Morse Taper Shank tools—with or without a tang. The other style is made in three sizes, which hold all sizes of straight shank tools from ¼ to ½-inch.

Booklet upon request.



No Keys or Collets Required

Aikenhead Hardware, Limited

17 Temperance Street, Toronto, Ont.

TRADE OPPORTUNITIES

Firms That are Asking for Trade Openings With Canada

Information can be obtained by firms interested in the following lines by communicating with this paper and mentioning key numbers.

1940 Metals.—A Manchester firm is prepared to consider offers of iron, steel, copper, brass, zinc, aluminum, and all kinds of scrap.

1942 Agricultural Machinery, etc.—A firm in Alexandria which has already sold Canadian agricultural machinery, would be disposed to negotiate with Canadian houses for agricultural machinery, cream separators, belting, pumps, etc.

1944 Foundry Materials.—A firm of manufacturers' agents are desirous of representing a house supplying foundry materials, such as iron rods, etc.

1945 Iron and Steel Products.—An English commisison agent located in Egypt enquires for Canadian iron and steel products and for hardware.

1946 Electrical Machinery and Apparatus, Pumps, Engines.—An important firm in Alexandria, representing several large English houses, enquires for Canadian products.

1954 Automotive Supplies.—A firm of manufacturers' agents in Barbados are open to represent a Canadian firm supplying a complete stock of automotive goods.

1618.—Machinery, machine tools. A South African firm of machinery agents is prepared to take up Canadian agencies for mechanical machinery of all kinds and machine tools.

1619.—Machine tools. A firm in Roumania desires to receive quotations and other particulars from Canadian firms in a position to export all kinds of machine tools.

1670.—Tools. A firm in Roumania desires to receive quotations and other particulars from Canadian firms in a position to export all kinds of tools.

1622.—Electric material, wood working machinery, tools. A house in Novi Ligure (Genoa) enquires for Canadian electric material, wood working machinery and tools.

SIGNS OF PROGRESS

Ald. G. H. Thomas has the contract for erecting an addition to the Galt Paper Box Co. on King Street., Galt, Ont.

Plans are being made by the Firestone Tire & Rubber Co., Hamilton, to establish a community town surrounding the site of their new factory which is now under construction. Besides workmen's homes, a library and school auditorium will be constructed.

It has been announced by the owner of the Walper House, Kitchener, that a two-storey addition is to be built to the hotel.

A new store is being erected on King Street, Midland, Ont., by the Copeland Flour Mills. The contract is in the hands of the Webb-Trew Construction Co., and if possible the building will be completed this fall.

The National Drug & Chemical Co., Ltd., are building an extra warehouse on DeCourcelles Street, Montreal, at a cost of $40,000.

L. R. Steel Co. have been given the contract for remodelling the St. Charles Hotel, Sault Ste. Marie. The cost is estimated at $60,000.

Plans are being made for the erection of a Woman's Building for the University of Toronto along the lines of the Hart House.

The Allen Theatre Corp., of Toronto, are negotiating for the erection of a theatre to cost between $300,000 and $400,000 and to seat between 1,500 and 2,000 persons, at Victoria, B.C.

Work will proceed at the earliest opportunity on the I.O.D.E. Memorial Hall for Children, at London, Ont.

German technologists gave a great deal of attention during the war to the possible use of blast-furnace slag for the manufacture of iron-Portland cement and brick making. According to an article in a recent number of "Stahl und Eisen," Herr Schol has perfected a process for making satisfactory bricks from "foam" slag or artificial pumice. This foam slag is apparently produced by passing molten slag horizontally into a vessel containing water. The steam evolved extrudes or puffs out the slag, which comes out in the form of a light porous mass. This material has been patented under the name of "thermosite" owing to its excellent heat insulating properties. In making the bricks the slag is first broken up and screened. The sand residue is mixed in certain proportions with slaked lime and forms the binder for the larger mass of "thermosite" of which the bricks are formed. A special press is used for making the bricks, which are left to dry for a month before being used.

The famous Udi coalfield in Nigeria, Western Africa, has now been developed to such an extent that a programme for the next forty years' work has been drawn up. It is proposed to make the output 1,000 tons a day, on the assumption that there are 12,000,000 tons of coal in the seam now being worked. Work on the field was only started at the end of 1914, when there was no railway within some hundreds of miles. In the spring of 1916 a railway to Port Harcourt, 151 miles distant, was completed.

It was recently announced by the Western Australian Minister of Mines that an English company is making preparations for working extensive deposits of graphite in that state. It would appear that this deposit is one of the biggest in the world, and that, in view of the fact that the world's requirements are something like 300,000 tons per annum, and that most of the big sources of supply are dwindling, the enterprise should prove of great value.

The proposed extension of hydro-electric projects in Japan, according to "Commerce Reports," will involve the building of about 1,000 miles of high-pressure transmission lines within the next two years. Most of the construction will probably be of the steel tower type. Copper has hitherto been used exclusively for the heavy transmission cables.

INTERESTING FACTS TO BE FOUND IN THIS WEEK'S ADVERTISING SECTION

How an air hose coupling will quickly pay for itself by stopping costly leaks.

How one firm goes about it to grind piston rings, one at a time, at a rate of 1,800 per 8-hour day.

Where the die division of one firm offers to supply a set of standard chasers in carbon steel with each die.

A small furnace using either oil or gas that is good for machine shops for annealing and tempering dies, cutters, reamers, etc.

There is a hydraulic press that has no spring or weight for returning ram.

A machine tool firm announces the bringing out of a new catalogue to interest users of milling and gear cutters and small tools.

How all intermediate cutters of babbitts have the same fatal defect of low fusibility.

A turret lathe that made a very good record in machining the cast iron flywheel.

How one firm specializing in drillers insists on three accuracy tests.

How one machine tool maker insists on the machine passing every test before the trade mark of the firm is placed upon the finished product.

How one milling machine is supplied with a lubricant pump and means for returning the lubricant to the reservoir in the base of the machine.

How a horizontal drilling and boring machine handles at one setting pieces too long for the usual type of machine.

Here is a firm willing to send a 64-page book containing a lot of information on the proper use of hack-saws.

How one forging machine makes engine pitmans with freedom from excessive fin and flash.



GENERAL VIEW HAMILTON WORKS



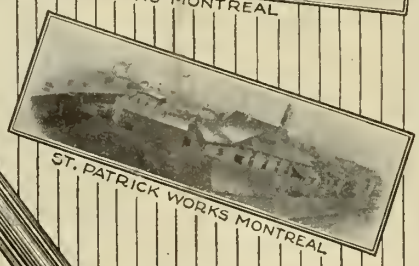
CANADA WORKS HAMILTON



DOMINION WORKS MONTREAL



ROLLING MILLS BELLEVILLE



ST. PATRICK WORKS MONTREAL

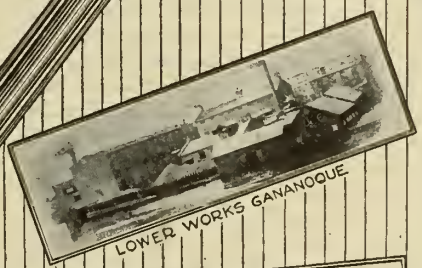
Quality

THE
STEEL COMPANY
OF
CANADA
LIMITED
HAMILTON MONTREAL

Service



BRANTFORD WORKS BRANTFORD



LOWER WORKS GANANOQUE



SWANSEA WORKS TORONTO



ST. HENRY WORKS MONTREAL



GENERAL VIEW OF NOTRE DAME WORKS MONTREAL

These Plants and the Organization that directs and operates them, stand back of and Guarantee Quality and Service at All Times

Exporters Should Study Conditions Closely

South Africa is Well Advanced in Many Lines of Practice—Some Cases Where Exporters Have Made It Very Hard for Their Goods to Be Favorably Considered.

FIRST hand information on the requirements of importers in the overseas countries and their experiences with goods of various countries is always of interest to the manufacturer who is interested in export trade. Recently "Canadian Machinery" had the opportunity to speak to a South African engineer, who is visiting the United States and Canada to interview the firms whose goods his company handles out there.

This gentleman's firm imports and erects refrigerating machinery, steam engines, electrical apparatus, general engineering supplies, and also some agricultural machinery. Incidentally to show that the South African farmer is moving with the times, this one firm has supplied over 1,600 sets of farm lighting equipment of a well known American make. They have supplied a large number of steam driven electric lighting sets to various municipalities, there being little water power available, except at the Victoria Falls, and they are far too distant to be useful. Oil engines they do not recommend for South Africa, as the fuel has to be imported and the necessary skilled help is not always available. A large number of air compressors are used in South Africa, and these are mostly obtained from England. Engines are bought both in the United States and England, and steam boilers from Great Britain alone. We aroused our informer's interest greatly when we informed him that he could procure boilers in Canada that would compare with any boilers he could obtain in any other part of the world, and he expressed a desire to visit some of the firms we mentioned and see for himself. On the subject of engineering brass goods, he informed us that Australia could in the matter of price, quality, and delivery, give points to either Great Britain, United States, or Canada. This was particularly true of small brass valves, from 1-4 inch to 2 inches.

Poor Shipping Practice

Speaking about shipping practice, our friend waxed eloquent. In fact he said that one of the principal reasons for his long trip to this continent was to try and get a proper understanding on the part of shippers as to how their product should be packed. His firm, he said, had lost thousands of pounds in the last few years by reason of extra charges on railways and lighters due to wrong packing. Asked for specific instances, he related one of a steam engine about 18-in. x 24-in. stroke, which was crated all assembled in one huge crate, and cost them hundreds of pounds in extra charges before delivery was made. In another case the very opposite mistake was made. This was a shell brine cooler, which of course consists of a tank with a coil inside. The tank, which could not come to much harm even if uncrated, was carefully crated, and the coil was removed from the inside and packed in another crate. He gave other instances where either too little or too much crating was used, and declared that endless correspondence did not seem to help matters. This trouble was not experienced with goods shipped from Great Britain, but was very noticeable with American and Canadian manufactured articles. On arrival at South Africa an extra large crate would have to wait weeks before a car could be procured to ship it on the rail, and then in some cases it would have to be shipped for many miles by road. This meant much delay. In some cases crates had been shipped that were too large for the ship's gear to handle, and this meant that special cranes had to be used both for loading and unloading.

Regarding locomotives, American made engines had not been very successful in South Africa, trouble being experienced in the copper fire boxes. The South African Government require this type of fire box, and those of American manufacture did not seem to stand up as well as those of British manufacture.

Engineering practice is well advanced in South Africa, and one plant was mentioned that is in course of erection where the steam pressure used will be 350 pounds per square inch.

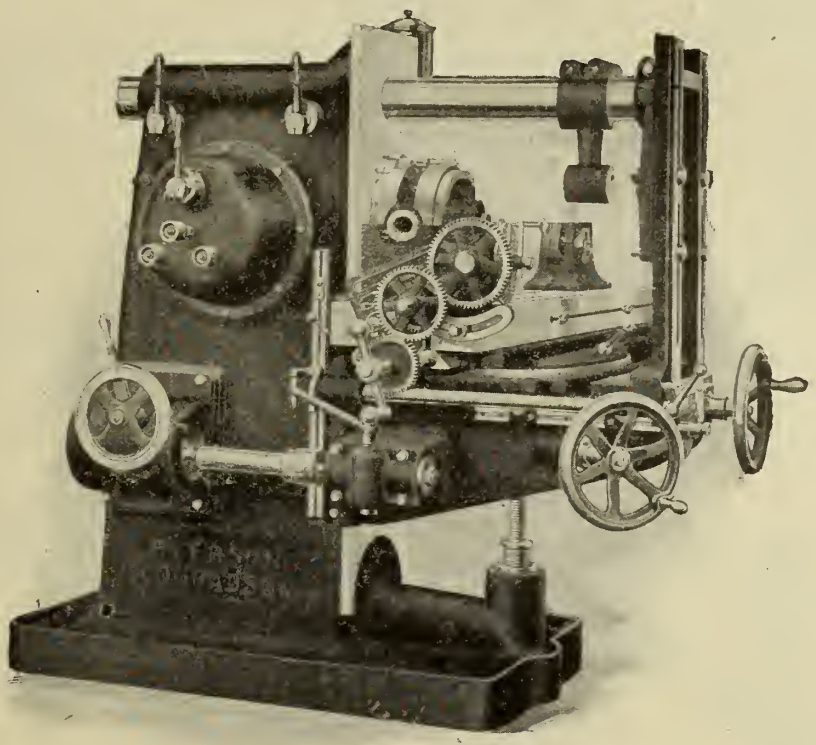
Want a Motor. — The Preston Woodworking Machinery Company, Preston, are in the market for a used 7½ h.p., three-phase, 25-cycle, 550 volt, 500 r.p.m. motor.



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MONTREAL WINNIPEG

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Says Foundry is the Boy's Best Opportunity

ANYONE connected with actual mechanical work in these days cannot help wondering why more boys don't go in the foundry work. Some authorities claim that there is more chance for advancement and ultimate big money in the foundry than in the machine shop, but though it is fairly easy to get boys for the latter, they scorn the job offered in the foundry. There are three reasons for this state of affairs, i.e., snobbishness, love of things moving, and lack of education as to the foundry's place in the industrial structure.

Parents are partly to blame for snobbishness. They don't want their boy to work in the dirt or to do manual labor; they want him "to take a better place" in the community than his father, through having a more genteel job. This idea is fostered in our schools where the whole trend is to look forward to "higher education," and to view "going to work" as almost a disgrace, or at best a loss of caste. The very thought of working in dirty black sand would be abhorrent.

Most red-blooded boys have a fondness for machinery in any form, from the automobile down. This makes the machine shop an attractive place and is a drawing card that overbalances the dirt and grease of the job. Hence the machine shops in normal times can usually get the right kind of boys. But when they find that there is a great deal of hand work to do, in fact, that the highest degree of skill is hand work, then they somewhat lose in enthusiasm and they do their best to become machine hands rather than bench hands. The lack of machinery in a foundry and the seeming excess of physical exertion required for the work put molding in a class lower than the bench worker of the machine shop.

The foundry itself is also partly to blame. It needs to advertise. Foundry work constitutes a basic trade. Besides molding and core work, there is mixing, cupola practice, pattern work, cleaning and finishing. As to molding, there is the wide variety offered by bench and floor and loam work. Then there are the various molding machines, which offer some opportunity to do machine work, and, more important, to get familiar with manufacturing work. A study of the best way to mount and arrange patterns for machine molding and the gating of multiple patterns and cores generally will occupy the most ambitious one for some years. Taken altogether, there is as much variety in foundry work as in any of the other mechanical trades, considering shop practice alone, and if one wishes to get into the theoretical end he will find material for endless study.

Will this effort be worth while? There is not the slightest doubt of it, if a person is ambitious either as a matter of self-attainment or to rise in the profession. With the automobile calling for more and better castings than any ever before produced in quantities, it is no wonder that foundries in other lines feel the scarcity of experienced men, and of new blood. The chances in the foundry for boys who are energetic and studious are unusual, even for these times, because of the demand for workmen and executives, and because the foundry has attracted an average grade of help lower than in lines that did not offer so much "dirty work."

One foundry owner was bemoaning the lack of boys. His men were all piece workers and made as much money as they liked but there was a noticeable dearth of young men about the place. "If I could get three or four boys to stick until they had learned the trade thoroughly, then to go around in other plants for a couple of years—why, I could guarantee them $8,000 to $10,000 a year in ten years," said he. And that is big money in these days of high wages.

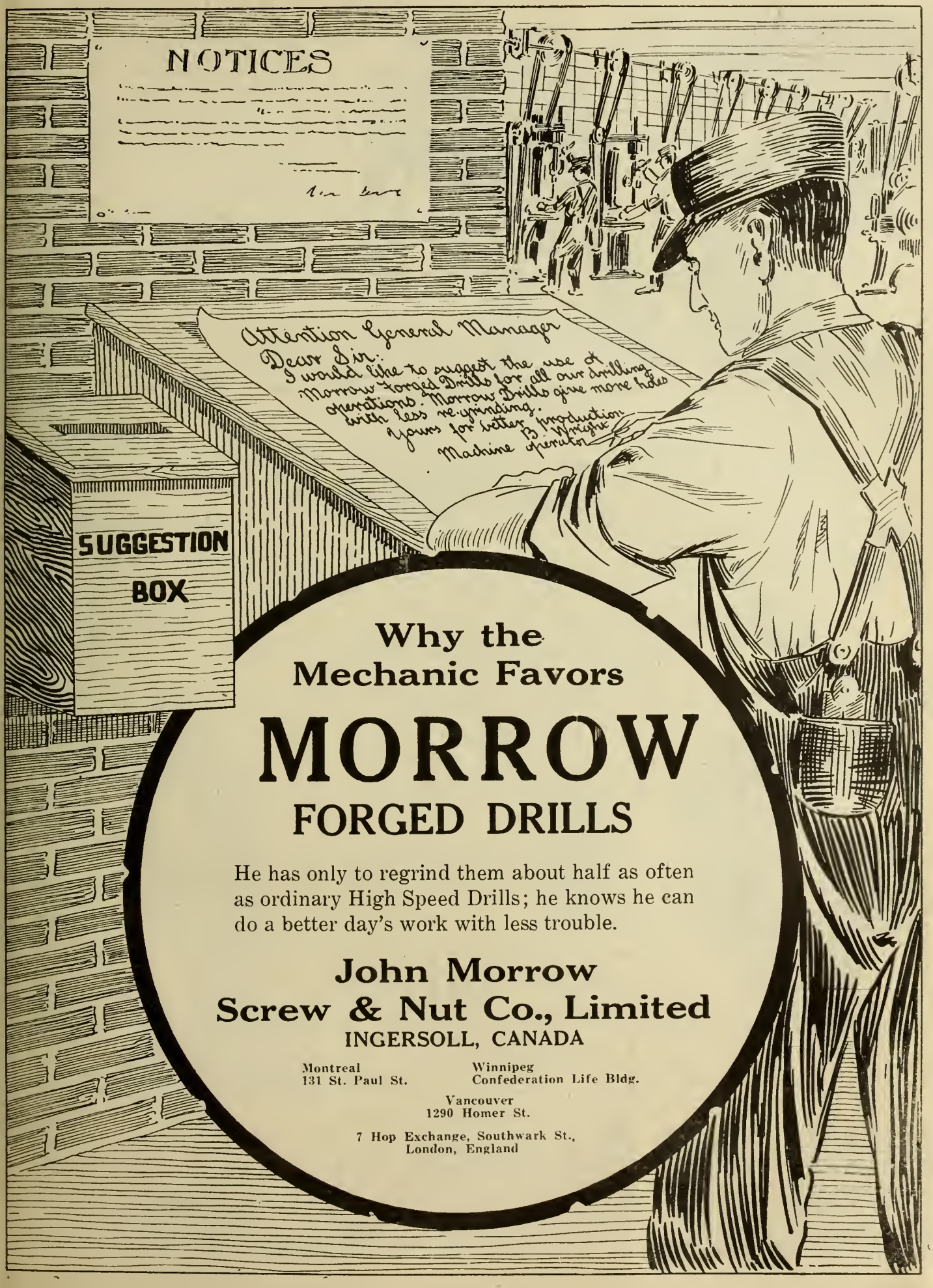
Another foundryman told the same tale. "I had one boy that was unusually bright, and had been with me two years. He had taken out a correspondence course and I had hopes of landing him in the office in the distant future. But he suddenly gave up his job and went over to Dexter's machine shop to work. I had a few words with him, advising him to be serious-minded and stick now that he had secured a more congenial place. But it was a matter of three months before I saw him working at the Bon Ton Garage, so I suppose he wanted less exacting work, more chance to sneak out for a smoke and the hurrah boys that is usually found around garages. I blame the automobile and the movies for the lack of application and the disinclination to work so marked to-day. It affects parents first, then the children, and the result is that foundry work is rated as beyond the pale for anyone except dago boys."

Still another foundryman bewailed the loss of competent executives and engineers. "If there were only enough bright fellows coming along to fill the salaried positions acceptably, we could stand the lack of skilled help," said this man, "for we can subdivide our work into simple operations within the ability of the foreign labor to be had—and this is the only labor that will do physical work these days. The men we have to promote are not possessed of the education to make a success of their positions as they should: the college trained men we get are all right on theory but they lack first-hand knowledge of the money-producing end of the business and they are too afraid of the dirt to spend a year out in the plant with overalls on. These college men would make the finest kind of department heads if they had the practical knowledge or, barring that, the molding room perspective; but, if I had to take my choice, I would prefer the man who has learned the trade in all its branches and has studied nights—he can get all the theory that he can ever use in just that way."

This brings us back to the claim that there is the biggest kind of a chance for boys right now in the foundries of the country. Ask the machine shop man what his greatest concern is, aside from dealing with his men, and nine out of ten will say, "Getting castings," or "Getting good castings." Go to a general machine shop and find out the percentage of work they throw away—then go to a general foundry and get the same information — a comparison will show whether or not there is a field for better methods and skilled men in the foundry.

If a boy has ambitions toward going into business for himself, he must select some business; why not make it the the side of the furnace. May I not draw foundry? It is assumed that he will work as an apprentice or a clerk to learn the minutiae of the business, then await an opportunity to embark in a small way on his savings or with borrowed capital. The foundry requires no more capital than business in other trades or in mercantile lines—less, if anything. A large part of the capital is tied up in "liquid assets" of the nonperishable kind, such as sand and pig iron and coke, commodities that have an immediate resale value at current market prices—business men in scores of other lines would rejoice if they were similarly situated. And there is no fear of a foundry lacking work. The writer lives a hundred miles from one of the great cities of the country—one that is not noted for manufactures in iron and steel—yet for the last six years there has not passed a week when there were less than three men from the big city, out on a regular tour of trying to place contracts with the country foundries within that hundred mile radius — and contracts at any price the foundries might name.

Some new records in shaft sinking are said to have been made recently in South Africa. The south shaft of the New State Areas was sunk 270 ft. in a month and the north shaft 245 ft. The shafts are rectangular, and measure 28 ft. 9 in. by 13 ft. 9 in. About the same time a cross-cut at the Sub Nigel, measuring 12 ft. by 8 ft., was extended 343 ft. 6 in. in the north.



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TRADE GOSSIP

The Welland Yards. — The Welland Telegraph, in a recent issue, said:

The British-American Shipbuilding Company is practically no more as far as Welland is concerned. Its doors have been closed and the activities of one of Welland's foremost industries are at an end. On Saturday afternoon the stern section of the "Canadian Squattor" left the shipyard and passed down the canal on its way to the Canadian Vickers Shipbuilding Yards at Montreal. The bow section left Wednesday of last week. This is the last boat that will be built by the British-American Shipbuilding Co. The loss of such a splendid industry is a serious one for Welland, but hopes are entertained that the plant, which is for sale, will be purchased. It is rumored that a prospective buyer is the Chicago Bridge & Iron Company, of Bridgeburg.

PERSONAL

C. W. Adams, superintendent of the Locomotive Department of the M. C. R., in St. Thomas, has been promoted to the superintendency of the M. C. R. locomotive plant in Jackson, Mich., which has over 2,500 employees. Mr. Adams is a St. Thomas man who learned his trade as a machinist in the M. C. R. shops here, and is considered one of the most efficient executives in the employ of the company.

Charles E. Potter, formerly manager of the City Dairy, Toronto, has been elected president of the Ontario Smelters and Refiners, Ltd., at Welland, and will from now on principally devote his time and attention to increasing the production of the plant. The company's principal customers and markets are, of course, the home market as well as that of the United States and England, but they have an extra heavy demand from the Orient, particularly China and Japan, where their products are favorably known among the pottery, glassware and ceramic industries. They also have substantial trade connections with the Latin-American countries where the purity and high standard of their products are well-known.

HANDSOME AND USEFUL CATALOGUE

The Wilt Twist Drill Co., of Canada, Ltd., Walkerville, Ont., Canada, have just issued their new Catalogue "C," which is well worthy of comment. This book is 8 x 5½ inches, and is bound in a very attractive cover, but the real meat is inside. To give it due justice it is not only a catalogue but a reference book as well.

The various sections are thumb indexed and are as follows: Suggestions for ordering drills, sleeves and sockets; suggestions for ordering reamers, counterbores, cutters, and miscellaneous tables and information. There are 240 pages to this book, and the illustrations and description throughout are of the very best.

A new brick that has recently been introduced in England is nearly five times as large as an ordinary brick, but in comparison is much less heavy and is easily handled. The lighter weight results from the hollowing out of the brick to provide air layers. By the shaping of the ends the existence of joints running all the way through a wall is avoided. The brick is, as a rule, made of one part of cement and four parts sand by simple hand machinery. Three men can make enough bricks in a day to build 400 to 500 square feet of wall. A further economy is effected by the manner of laying the walls, inasmuch as the ends and bottoms of the bricks need only to be dipped in a thin lime mortar mixed with a small amount of cement.

Some experiments on the purification of contaminated air by electrical means are described in a communication presented to the Academie des Sciences by Messrs. D'Arsonval, Bordas and Touplain. It states as follows. The air was drawn through a copper tube, in the axis of which was a wire maintained at a negative potential of 50,000 volts with regard to the tube, and although it was proved to contain originally 150 microbes per cubic metre, after electrification it was absolutely sterile. As experiments with dust particles had shown that the best results obtainable did not exceed a deposition of 95 to 97 per cent. of the particles, the authors concluded that the destruction of the microbes was partly due to the action of ozone.



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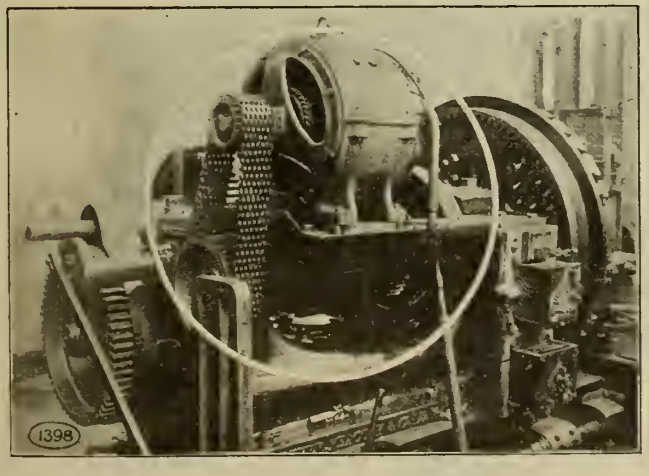
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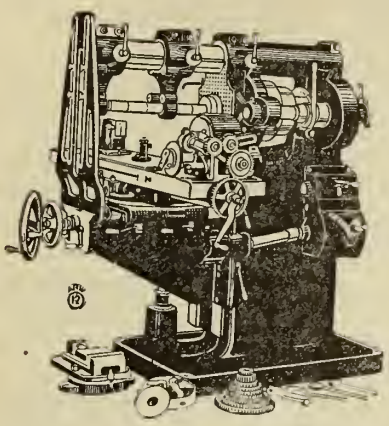
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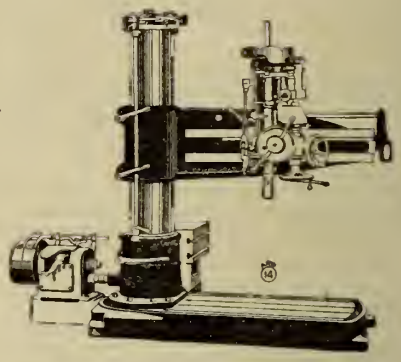
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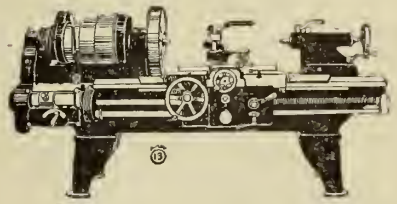
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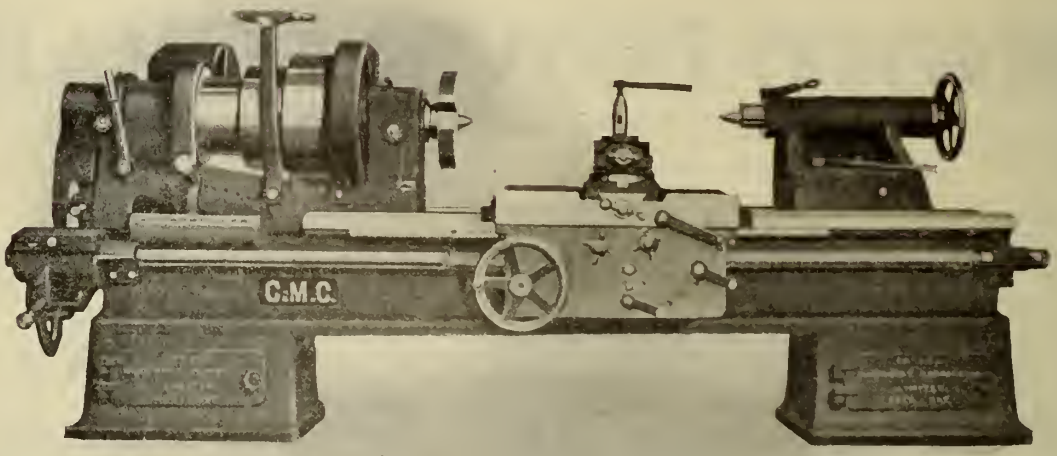
Fosdick 4' Plain Radial Drill.



LeBlond 19 x 8 Heavy Duty Lathe.

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Rebuilt 26 x 12 Heavy Duty Lathe.

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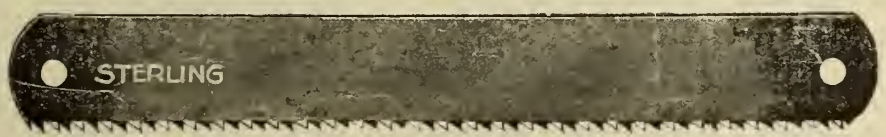
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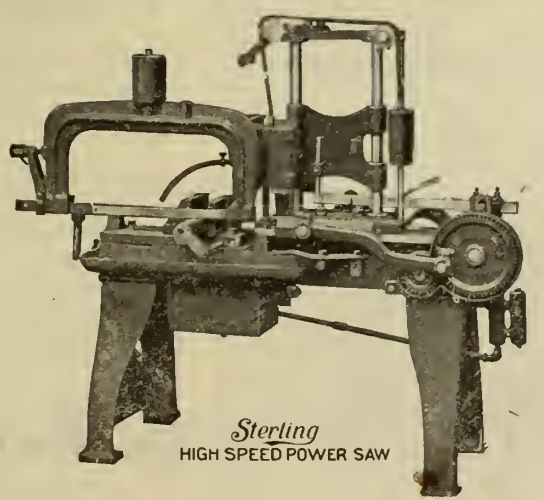
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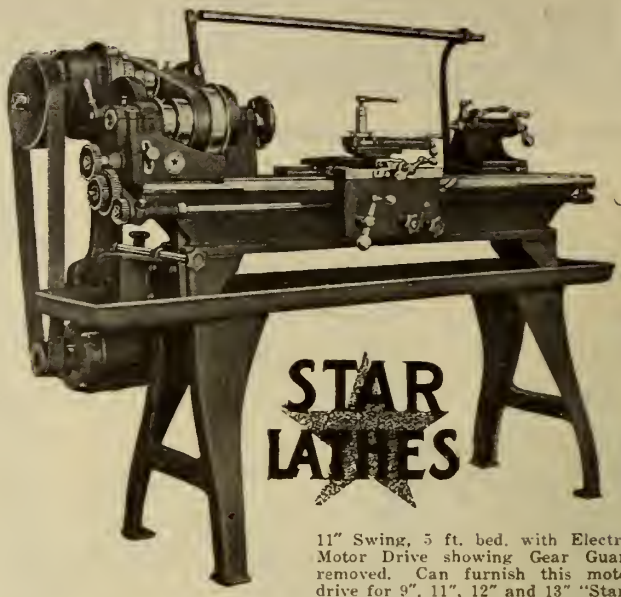
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One of the great advantages of motor driven **"Stars"** is that they do not have to be placed in alignment with the line shaft. Wherever the work is, there's the place for the lathe. And they require very little floor space.

The drive of motor-driven **"Star"** Lathes is very flexible, thus insuring exceptionally smooth running. The advantage of this feature will be appreciated by all who have had experience with "harsh" running machines.



11" Swing, 5 ft. bed, with Electric Motor Drive showing Gear Guard removed. Can furnish this motor drive for 9", 11", 12" and 13" "Star" Lathes on long legs or oil-pan.

Full particulars of all "Star" Lathes will be found in the "Star" catalog. Have you a copy?

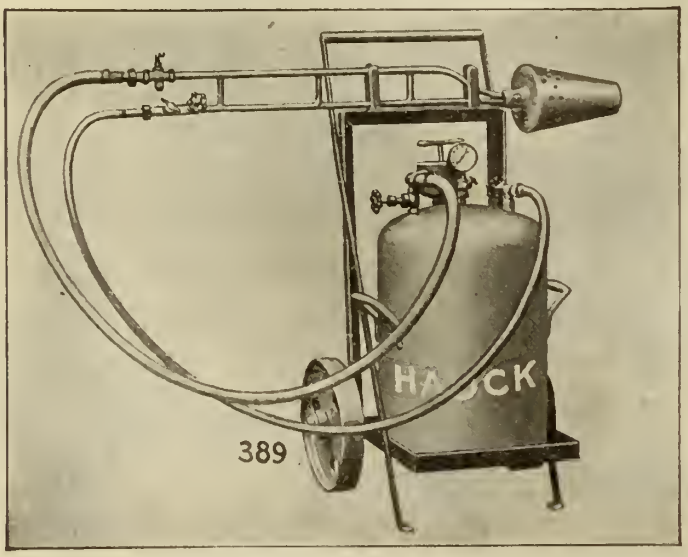
We also manufacture "Adams Short Cut" Lathe.

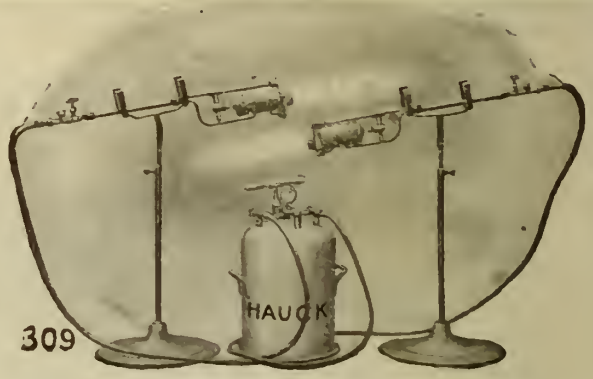
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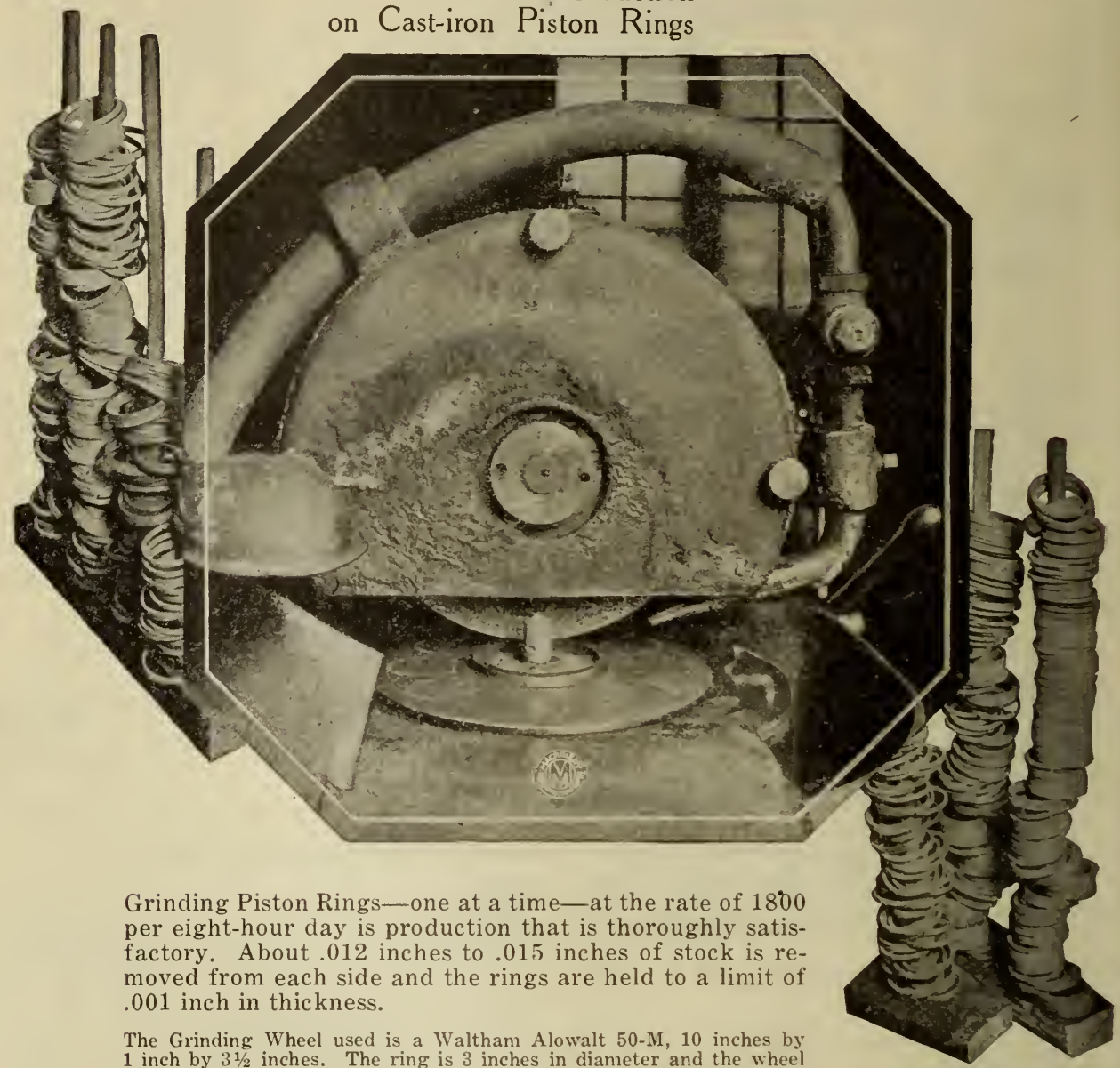
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Waltham Grinding Wheels are made in grades and grains that supply the correct wheel for every class of grinding work.

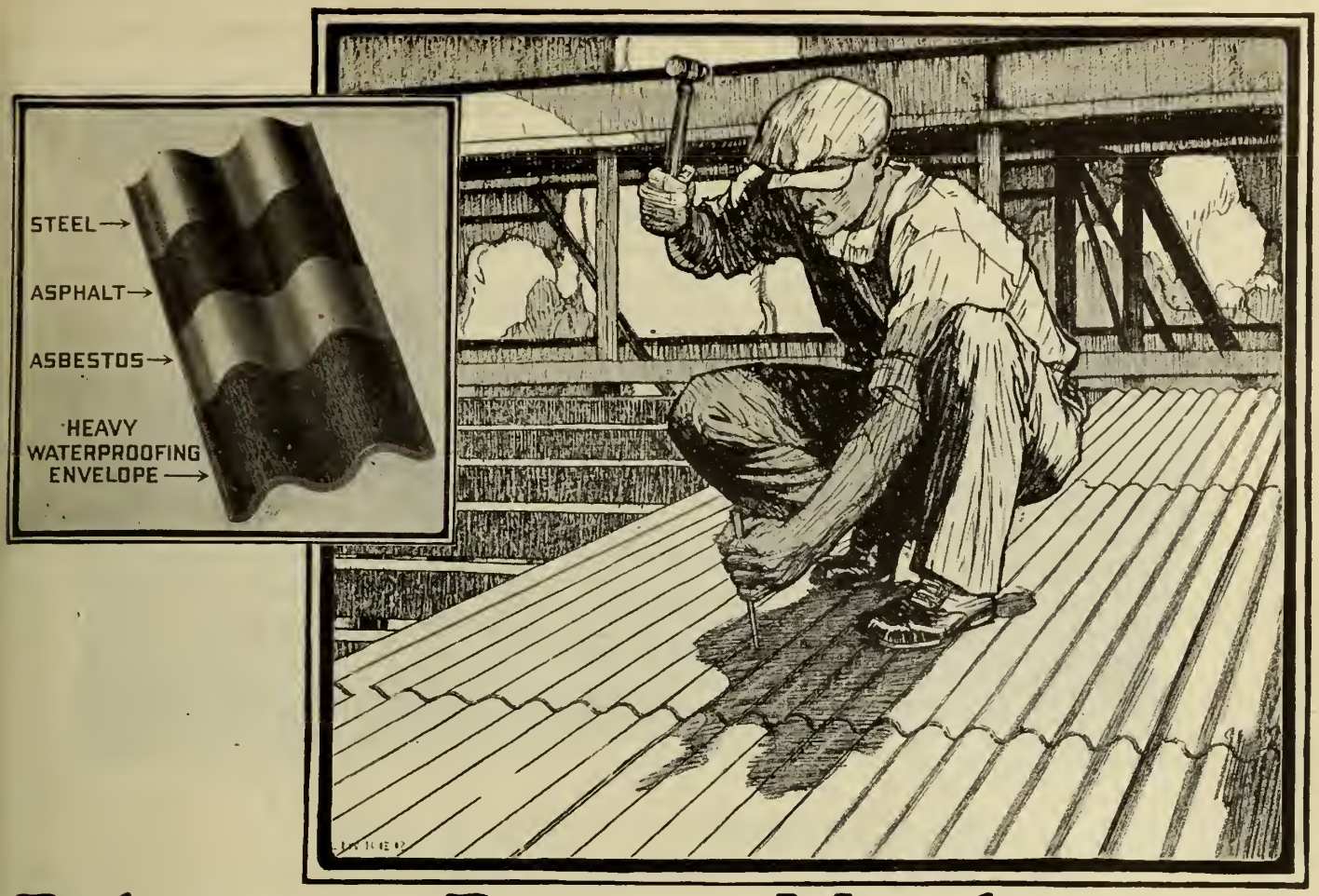
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Three tough coverings over a sheet of specially annealed steel make Robertson Process Metal unusually enduring. It is light in weight, saves structural steel and foundation costs and is therefore most economical for roofing, siding, ventilators, skylights, trim and other building purposes.

The sample illustration is a faithful reproduction of Robertson Process Metal. Note the method of protecting the steel core. This exclusive process preserves the original strength of the new unmarred metal for long periods of years, shielding it from all attacks of rust and corrosion. The result is a building material that withstands smoke, gases, acid and alkaline fumes as well as the most severe weather conditions.

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Oliver Machinery Company

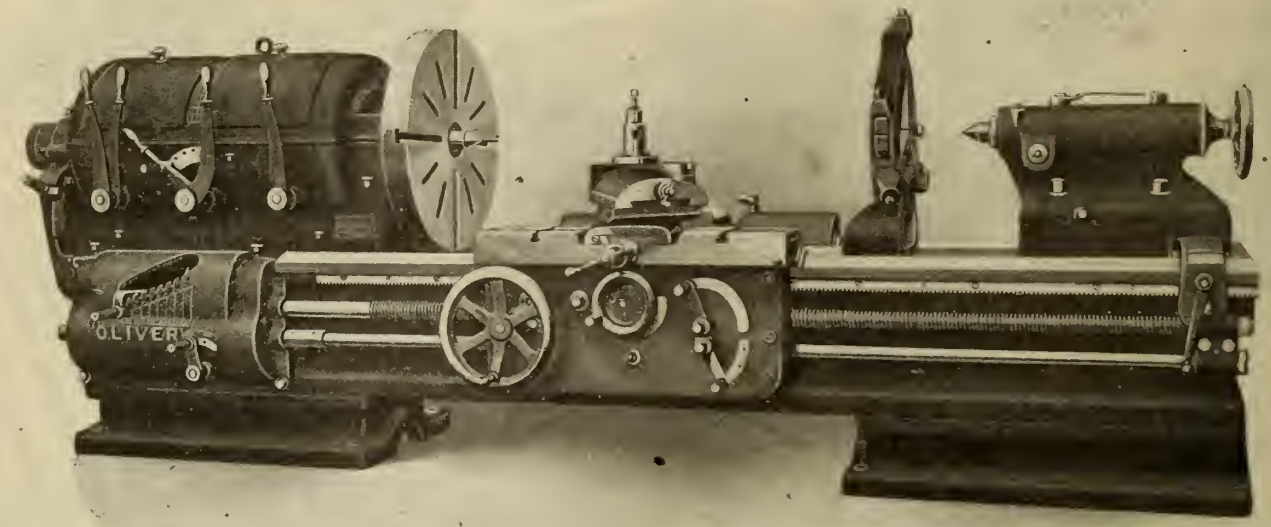
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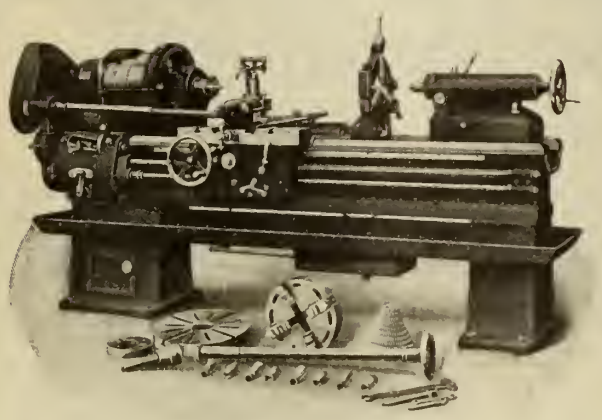
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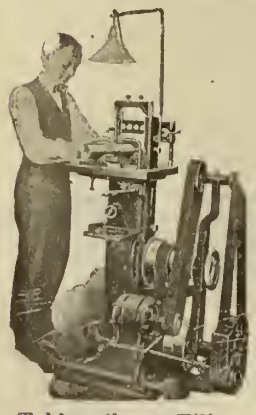


"Oliver" 30-inch Extra Heavy Duty Engine Lathe—All-Geared Head—Single Pulley Drive



"Oliver" 18-inch Tool Room Engine Lathe

"Oliver" Engine Lathes are built in sizes from 30-inch (diameter of work) to 16-inch inclusive. Arranged for Belt or Motor Drive. "Oliver" Lathes are powerful, being built to last under heavy cuts taken at high speed; at the same time they are accurate and may be supplied with such extras as taper attachment, relieving attachment, draw-in attachment and collets for special or tool-room work. "Oliver" Engine Lathes are built to cut threads, also plain for fast production work. Working parts are interchangeable. Cylindrical parts are ground and sliding surfaces scraped on master surface plates. "OLIVER" ENGINE LATHES ARE HIGH GRADE TOOLS.



The "Oliver" No. 404 High Power Filing Machine

(Rearwin Patent)

This is a powerful filing machine for heavy and fast filing, sawing or grinding of tools, cutters, dies, templates, punches, metal patterns, jigs, gauges, etc., etc.

The "Oliver" No. 404 is a large machine and uses files from the 3-inch needle up to a 12-inch bastard file. Standard files are used. Stroke is adjustable, also the position of file. Table tilts. Filing machine may be furnished with overhead support arm, lower support clamp or rollers to make machine portable. A wonderful labor-saving tool.



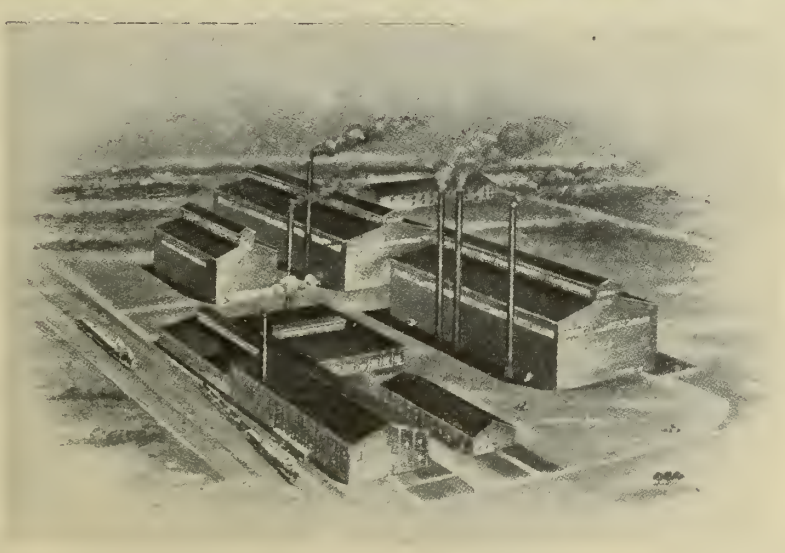
"Oliver" 12-inch Speed Lathe

This lathe will find many uses in any shop. May be arranged for belt or motor drive. Bearings are removable and interchangeable. Regularly equipped with Hand Feeding Carriage, Compound Swivel Rest and Set-Over Tail Stock. Quick action, Lever Tail Stock and Draw-In Attachment may be supplied.

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JIB CRANES, ASH HOISTS, RUNWAYS

Morton Travelling Head Planer

Handles Large or Small Work With Equal Economy

With the Morton Travelling Head Planer you can tackle the most difficult jobs with the certainty of being able to complete them economically and expeditiously. It handles both large and small work with maximum economy.

The multiplicity of operations of the Morton Travelling Head Planer makes possible the complete machining of difficult jobs at one setting of the casting. This tool operates as a draw-cut planer but may be quickly converted to operate with a push cut. It bores, mills and drills at right angles to the ram, as well as in the same plane. Special attachments may be obtained for spherical boring.

Special Features

It may be used either as a portable or stationary machine as the bottom side of the bed is planed.

It is reversible and may be quickly converted into a large, horizontal, travelling head slotter.

All milling, boring and planing feeds and adjustments may be quickly changed to meet conditions.

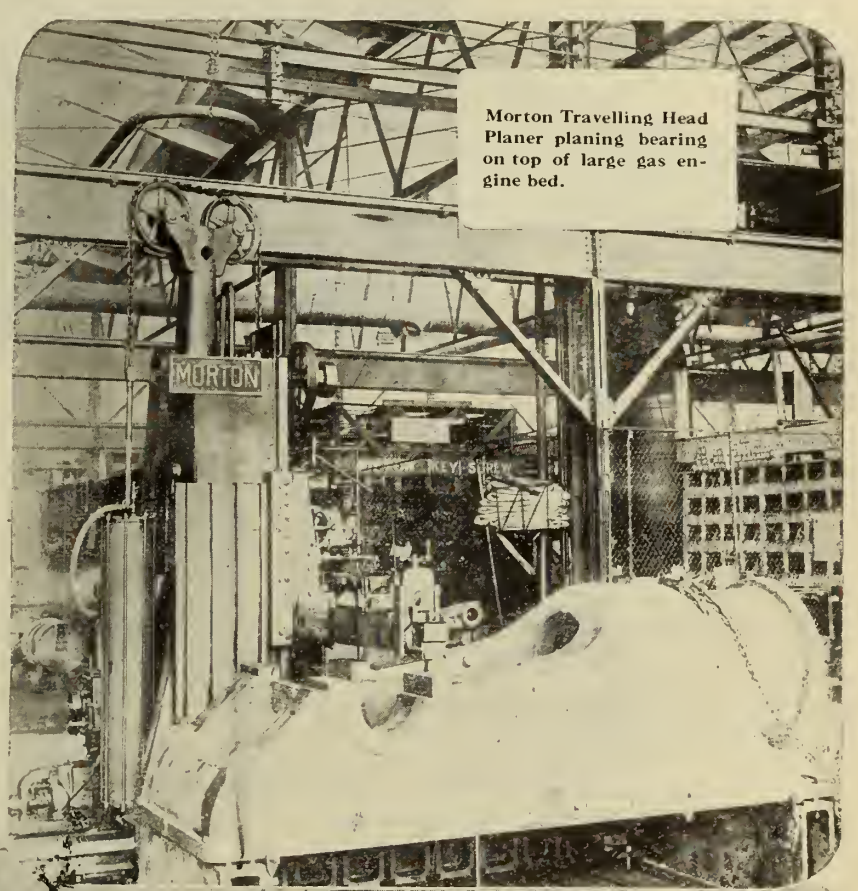
It will vertical mill and drill at right angles with the ram, at any 90-degree point of an arc.

Every operating lever is within easy reach of the operator.

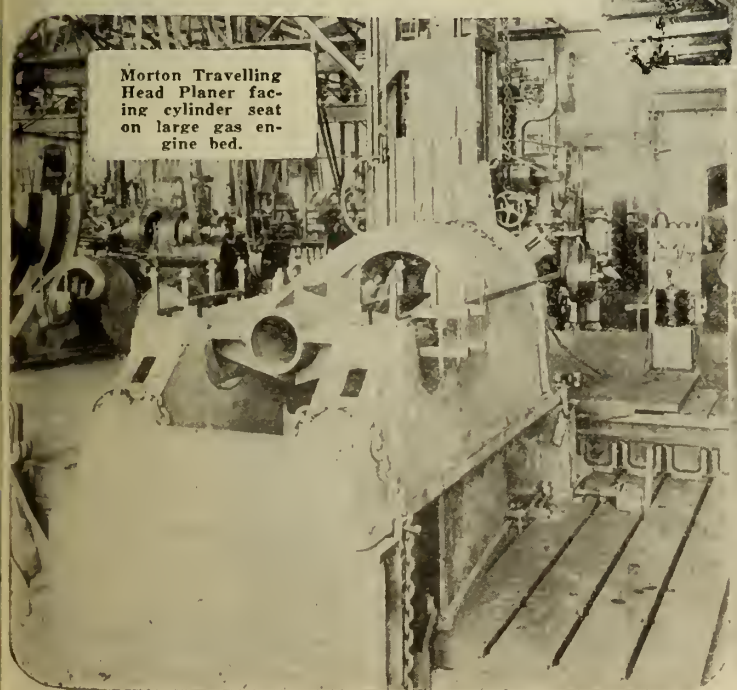
It requires one-half the floor space and one-fourth the power of a housed planer of equal capacity.

Complete Information in Bulletin No. 8A.
Write for it to-day

Morton Mfg. Co.
Muskegon Heights, Mich., U.S.A.



Morton Travelling Head Planer planing bearing on top of large gas engine bed.



Morton Travelling Head Planer facing cylinder seat on large gas engine bed.



Morton Travelling Head Planer facing journal end on large gas engine bed.

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What Is Your Equipment Doing?



Weston Model 155 A.C. Voltmeters and Ammeters are ideal, moderate priced, portable testing instruments for taking various readings frequently required in an industrial plant; readings that do not necessitate nor justify the use of highly accurate and more expensive Laboratory Standard Instruments.

The Model 155 maintains the superior Weston Standard for accuracy, workmanship and permanent service. This instrument is of the electro-magnetic principle and is contained in a dust-proof, polished black walnut case with leather carrying handles.

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Forging Engine Pitmans on the

NATIONAL

Heavy-Pattern Forging Machine

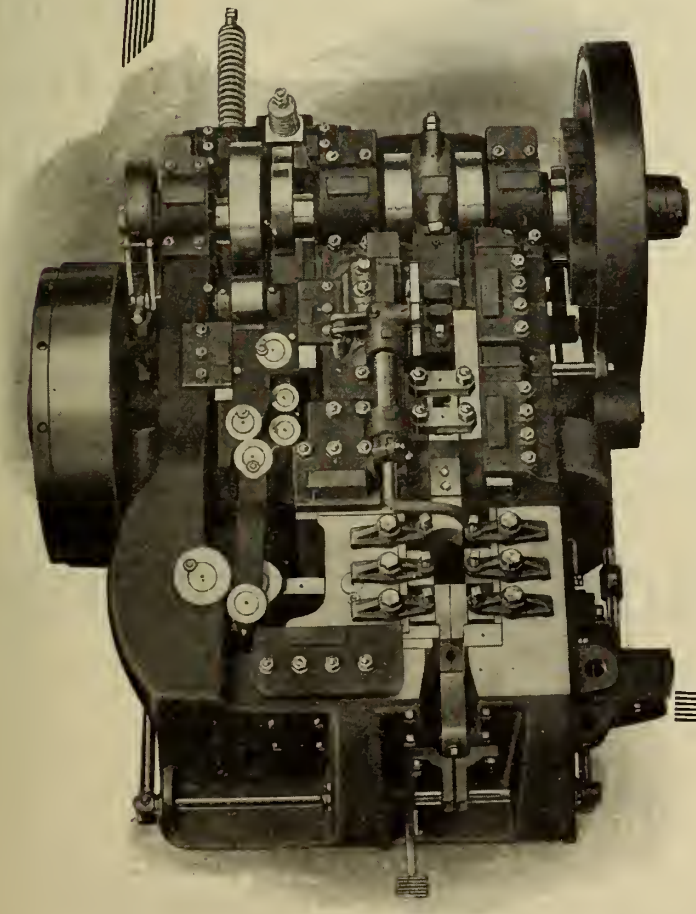
(STEEL BED)

The stem of the pitman is 2½ inch diameter, the maximum dimension of the head 9⅝ inches, width 5⅜ inches and the bearing radius 2¾ inches.

From these several dimensions the forge man will recognize this an extraordinary job; also that it takes a Forging Machine with extraordinary power and "grip."

The job is held to close dimensions, the corners well filled, and there is freedom from excessive fin and flash.

The National Heavy Pattern Forging Machine, plus National Engineers, is solving many big problems like this.



The National Machinery Company

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Are You Receiving
National Forging Machine
TALKS?

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The Fact is, that this apparatus renders such long-continued service, with so little trouble, that this world-wide conviction was bound to come.

Any Rego users will tell you, if asked, that the elimination of the flash-back, faster welding and cutting on smaller gas consumption, and freedom from burnt tips, have made the Rego the greatest development in the history of the Oxy-Acetylene Process.

Ask us for particulars or for a demonstration.

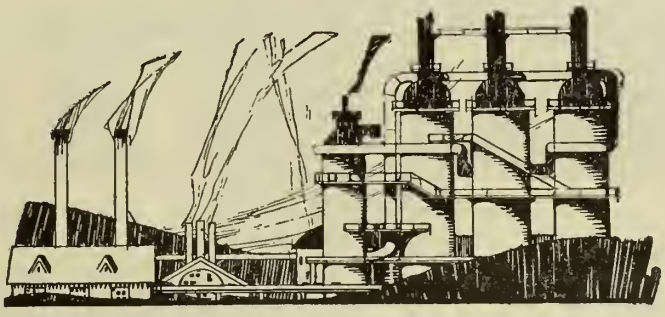
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AGENTS:

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Founded upon an absolute trust in Canadian development, it looks forward to a far greater Dominion than has yet been conceived.

Firm in this faith, it has planned a chain of modern plants for the production of pure oxygen. Any one of the contemplated plants could adequately supply the demand of today.

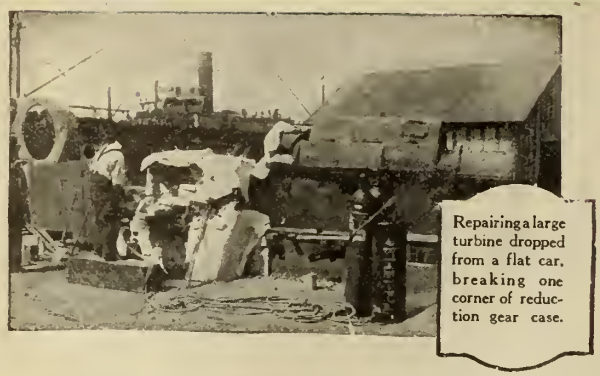
Canadians, of this and future generations, may rely upon the best service from an organization whose very existence depends upon the prosperity of the Dominion.

The Dominion Oxygen Company, Ltd., will, from time to time, apprise the public of the progress of its building program and in the meantime it invites the inquiries of Canadian oxygen users as to its broad scope and liberal policy.

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In addition to our eight factories, five Distribution Stations have been established at St. Johns, Nfld.; Sydney, N.S.; Quebec, Que.; Ottawa, Ont., and Windsor, Ont., respectively for an immediate supply of Oxygen and Acetylene to consumers located in these Districts, with a minimum of freight rates and the elimination of delays occasioned by long distance haulage.

At the present time as in the past, L'Air Liquide is in a position to give service which is unassailable.



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Perfectype COMPLETE WELDING and CUTTING Equipment

Safe *Saves Money* *Makes Better Welds*

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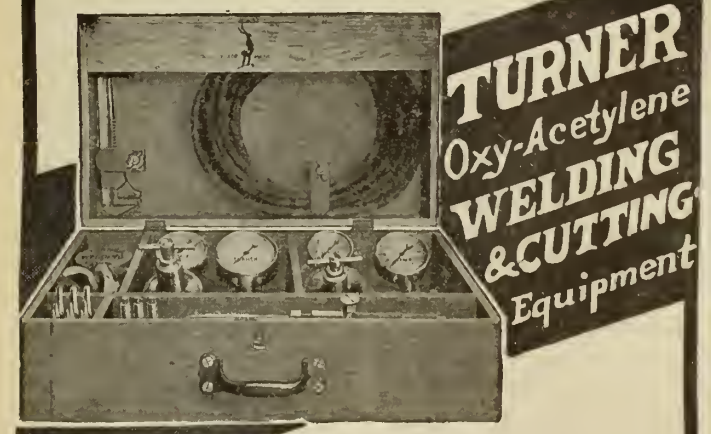
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Will consider inquiries from live dealers and jobbers who care to stock torches in lots of five or more. Territory granted. Inquiries confidential.

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For Repairing Broken Machinery or Tools of Medium Size

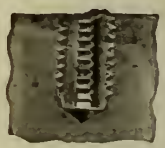


These outfits will soon pay their cost in machine parts or tools reclaimed. The sectional extensions of the torch enable the operator to adjust it to any desired length or angle. The location of valves is such that the flame is controlled by one hand, leaving the other hand free for the work at all times.

For full particulars write

The Turner Brass Works
SYCAMORE, ILLINOIS, U. S. A.

Buried in the Work and Broke!



Next time a tap breaks below the surface of a large casting, don't let some makeshift method of removing it injure the thread and waste half an hour of valuable production time. Instead—



Walton it Out in a Jiffy
and save the casting

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself.

WRITE

The Walton Co.
Hartford, Conn.

Electric and Oxy-Acetylene
WELDED TUBING
Also BUTT SEAM TUBING

THE TUBE COMPANY OF CANADA LIMITED

We have a thoroughly equipped plant for Welding by Electric and Oxy-Acetylene processes. Oxy-Acetylene Welded Tubing is recommended for bending purposes; Electric for straight, or slight bends. Butt Seam Tubing is also one of our specialties. Tubing made hot or cold rolled finish.

Our Work Includes Tubing for

Bicycles, Bedsteads, Automobile Parts, Electric Fixtures, Gas Fixtures, etc. Round, Square, Rectangular and Special Shapes. Sizes ⅜″ to 2″ outside diameter, from 16 to 22 gauge.

Let us advise you of the kind of tubing that will best suit your requirements. Inquiries gladly answered.

The Tube Company of Canada LIMITED

233 Dufferin Street, TORONTO, Canada

FROST KING BABBITT

will withstand heavy pressure without increasing its temperature.

For general machinery bearings it is without a peer.

If you are from Missouri try a sample lot and be convinced.



HOYT METAL COMPANY
MONTREAL TORONTO WINNIPEG

Manufacturers:
The Sheffield Twist Drill & Steel Co. LIMITED
Works: Summerfield St., Sheffield

Telephones: London City 2660. Sheffield - 712. 710. Code ABC 5th Edition

LONDON OFFICE: Suffolk House, 5, Laurence Pountney Hill, London, E.C. 4.

Telegraphic Address: "Proells, Sheffield" "Proells, London" "Proells, Paris"

HIGH SPEED TWIST DRILLS

DORMER BRAND

Canadian manufacturers who wish to buy the HIGHEST QUALITY tools and who wish to promote trade within the Empire will find that "DORMER" Brand Drills meet all requirements. They have the strength that stands wear and tear, and they are irresistible in their piercing functions. Large stocks on hand for prompt shipment. Quality drills for quick drilling—use "Dormer."

Canadian Agents:
Forrest, Jackson & Forrest
222 Craig Street West
MONTREAL CANADA

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VOLTA
Electric Furnace

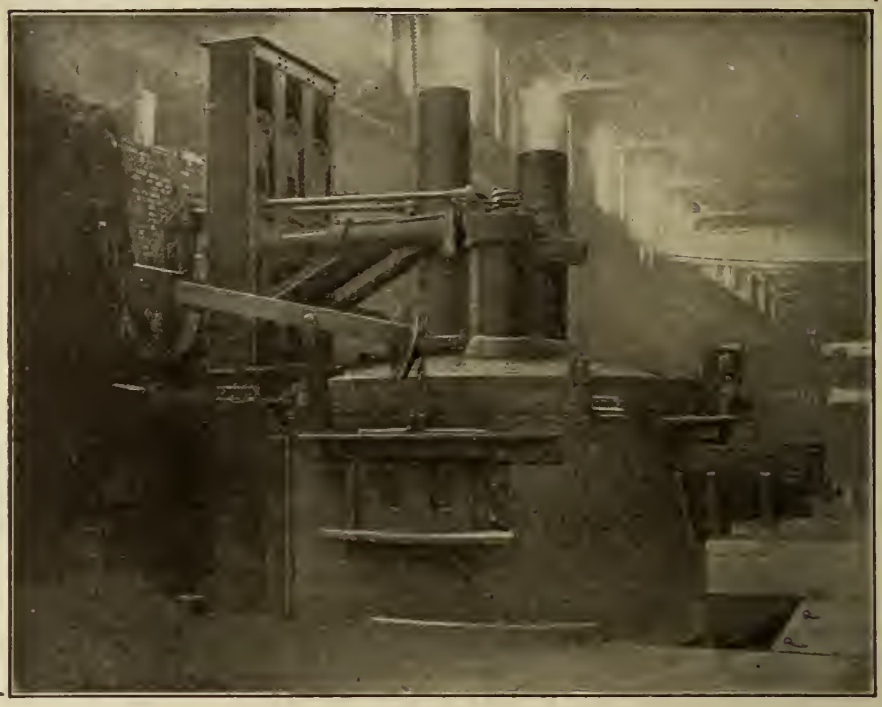
For economy, it is essential that the furnace be so designed and equipped as to reduce to a minimum the refining time and delay between heats.
Volta Furnaces are the result of 10 years' experience **and nothing is spared to make them efficient.**
We are capable of advising you on your steel casting proposition.

Volta Manufacturing Co., Limited
WELLAND - ONTARIO

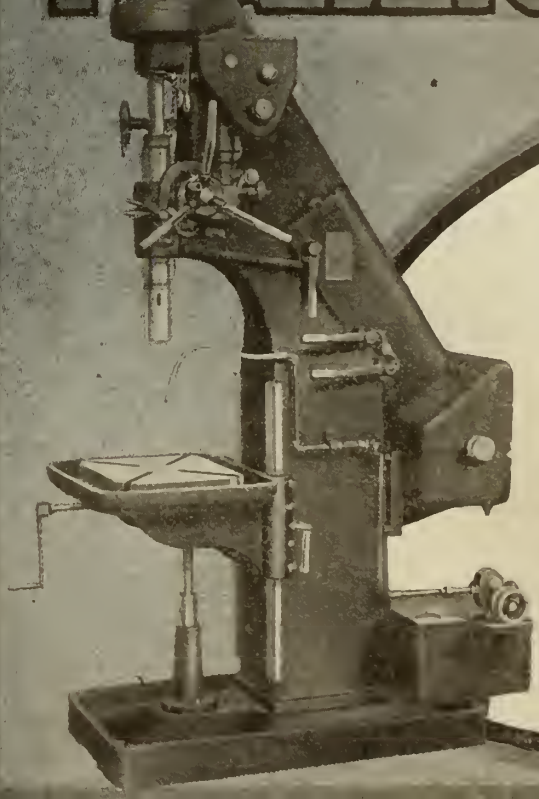
BESIDES being cheaper, electric steel castings have other advantages over ordinary steel castings. The product has a particularly homogeneous structure, a fine grain, superior physical properties, and a chemical composition which can be perfectly controlled.

FOR QUALITY CASTINGS

Illustration shows 6-ton VOLTA Furnace in running position



TRAHERN PUMPS



A TRAHERN PUMP
on the Barnes 22" Self-Oiling All-Geared Drill

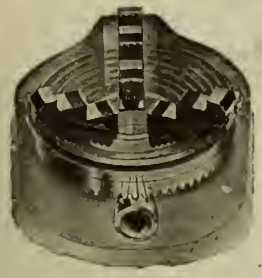
Barnes Drills are known through the industry as Quality Tools and we are proud of the fact that Trahern Rotary Geared Coolant Pumps were selected by the Barnes people as being the most efficient for installation on their product.
Ninety per cent. of sales of Trahern Rotary Geared Circulating Pumps are to Machine Tool Manufacturers who furnish them as regular equipment on their product. They take the initiative, install Pumps which are KNOWN to be efficient, and thus leave nothing to chance.

May we send you a sample pump at our expense?

TRAHERN PUMP DIV.
Geo. D. Roper Corp.
ROCKFORD, ILL.
U.S.A.

WILLIAMS & WILSON, LIMITED

Cable Address "Willwills" Montreal, P.Q. Established 1891





Taylor "Improved" Patent Spiral Self-Centering Lathe Chucks

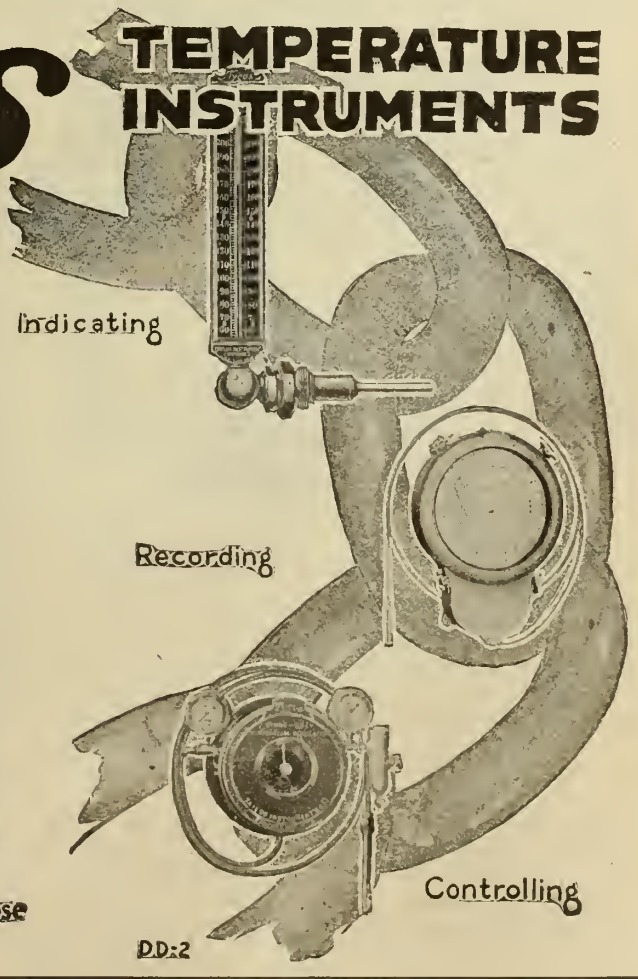
Double the Gripping Power

The design and construction of Taylor Spiral Chucks give more than 100% increased strength, power and accuracy of grip as compared with the ordinary scroll chuck.
This increased efficiency is necessary to take care of modern high speed production.
We have a catalog showing in detail the advantages of the Taylor "Improved" Patent Spiral Self-centering Chucks. Send for a copy to-day.

We are glad to announce that we can now make shipments of these chucks from stock

WILLIAMS & WILSON, LIMITED
84 Inspector Street - MONTREAL

Tycos TEMPERATURE INSTRUMENTS



The Basic Factors of Industrial Control

IN practically all the process work of modern industry *Tycos* Indicating, Recording and Controlling Temperature Instruments are standard today.

A lifetime devoted to the solution of special temperature problems has resulted in the development of these instruments to a point of dependability and precision which has not been surpassed.

A request for information on Tycos Instruments will bring you complete data without obligation.

Taylor Instrument Companies
ROCHESTER N.Y.
There's a *Tycos* or *Taylor* Thermometer for Every Purpose

If interested tear out this page and place with letters to be answered.

PACKINGS



Take packings—rod and sheet—away from the Marine Field, and even the most inexperienced knows what would happen.

With the operation of practically all kinds of vessels so utterly dependent on rod and sheet packings to allow proper operation, why use any but thoroughly reliable and well-known products?

DANIEL'S P. P. P. ROD PACKING

Probably the best known rod packing on the market. Unequalled for the packing against steam, water, air, ammonia, and other fluids.

Many practical tests by experienced engineers under various conditions have clearly demonstrated that P.P.P. is the most economical rod packing to use. Its long life is remarkable, its ability to create a saving in the fuel bill is well known.

"The Story of Some Friction Test"

is a booklet that should be in the hands of every marine engineer and others who have anything to do with rod packing.

EBONITE SHEET PACKING

Used on many of the largest vessels plying the lake and ocean trade for high pressure, super-heated steam, hot water, ammonia, oils and all other kinds of joints requiring packing.

EBONITE will hold a vibrating joint absolutely tight, and where there is a varying expansion or contraction of the pipes EBONITE is especially desirable.



Sole Manufacturers:

QUAKER CITY RUBBER CO., PHILADELPHIA, PA., U.S.A.

General Canadian Agents:

LA SALLE

Has an Advantage Over Other Grinders

There is some outstanding feature of all La Salle Grinding Machines that lends it exceptional productive ability.
The American Drill Grinder is especially adaptable for grinding twist, flat and three-lipped drills, because it has automatic lip rest and caliper jaw device, which assures proper clearance on all sizes of drills automatically. Send for descriptive matter covering our entire line of grinding machinery.



American Drill Grinder
For Wet or Dry Drill Grinding 1/8" to 2¼". Also 1/4" to 3½" dia.

LA SALLE TOOL CO.

La Salle, Illinois, U.S.A.

Represented in Canada by

A. R. Williams Machinery Co., Ltd.

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GENUINE EMERY

Sizes 180, 160, 140, 120, 110, 100, 90, 80, 70, 60, 54, 46, 40, 36, 30, 24, 20, 18, 16, 14, 12, 10, 9, 8, hole.

EMERY FLOUR AND WASHED FLOUR

Emery
Glass
Flint
Garnet
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Paper and Cloth

In Sheets, Rolls, Discs, Bands, Strips and Tapes, &c.

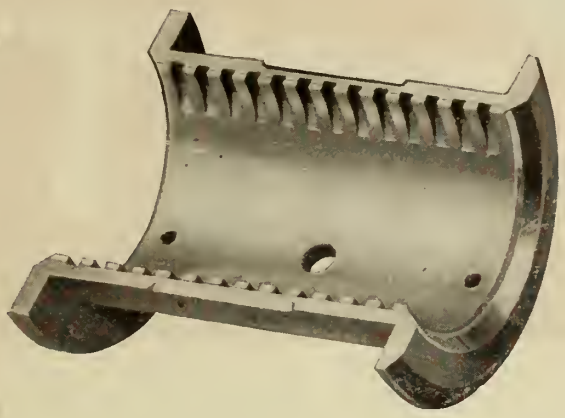
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BABBITT LINED BRONZE BEARINGS FOR INTERNAL COMBUSTION MOTORS





DIE CASTINGS

DOEHLER PROCESS

Manufactured by



Tallman Brass & Metal Limited
HAMILTON, ONT.



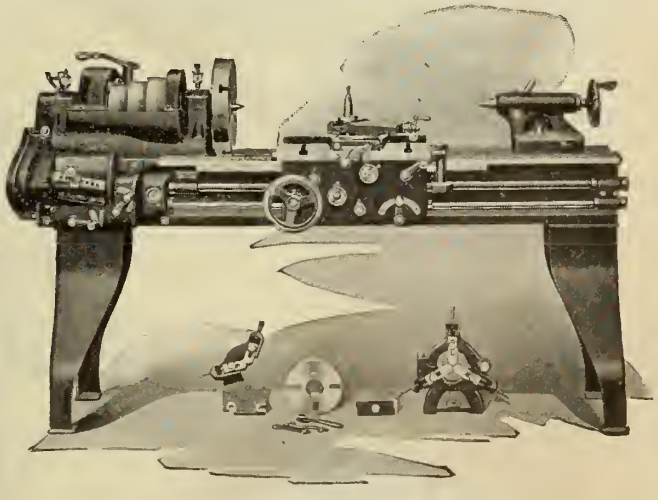


Built For *Service*

This BLOUNT Motor-driven Lathe is well adapted to all speed lathe uses. It is of late design, and has a number of features in which you will be interested. Provided with constant-speed motor. Lathe spindle made of hollow, high-carbon steel, ground to size and bored for Morse taper. Runs in self-oiling bronze bearings.

"We will accept Canadian funds at par"

J. G. Blount Co., Everett, Mass., U.S.A.



Extreme Precision

The "Economy" 14-inch Swing Double Back Geared Quick Change Engine Lathe, though small in size, is of sufficient weight and power to handle the rapid production of the modern manufacturing plant. Its high grade and extreme accuracy make it particularly adapted to the tool room. Made in 14", 18" and 22" swing.

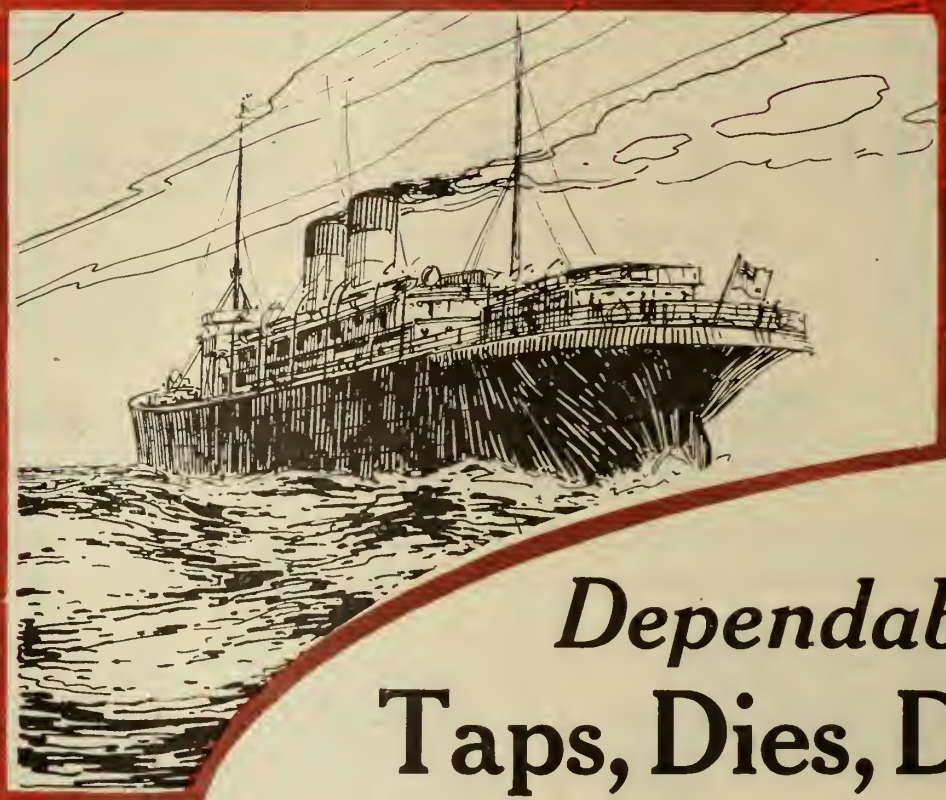
Have us send you full particulars of this small, heavy duty machine without delay.

Rockford Lathe and Drill Co.
Rockford, Illinois, U.S.A.

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BUTTER









Dependable

Taps, Dies, Drills Reamers and Milling Cutters

Order from our nearest representative — see list below.



BUTTERFIELD &

UNION TWIST DRILL CO.

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FIELD







Butterfield Tools in World-Wide Use!

Butterfield Taps, Dies, Drills, Reamers and Milling Cutters are in use in Great Britain, France, Italy, Belgium, Switzerland, Sweden, Norway, Denmark, Spain, Greece, Netherlands, Japan, Argentine—practically every important industrial centre of the world. Butterfield tools are in demand because they are dependable in quality and correct in design. Try them and watch results.

COMPANY DIVISION

ROCK ISLAND, QUE., CAN.

220 King St. West

Representatives

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Handles at One Setting Pieces Too Long or Too Bulky for Usual Type of Machine

Double setting of work not only wastes time but is a frequent cause of error when boring holes for shafts or bearings which must be exactly parallel.

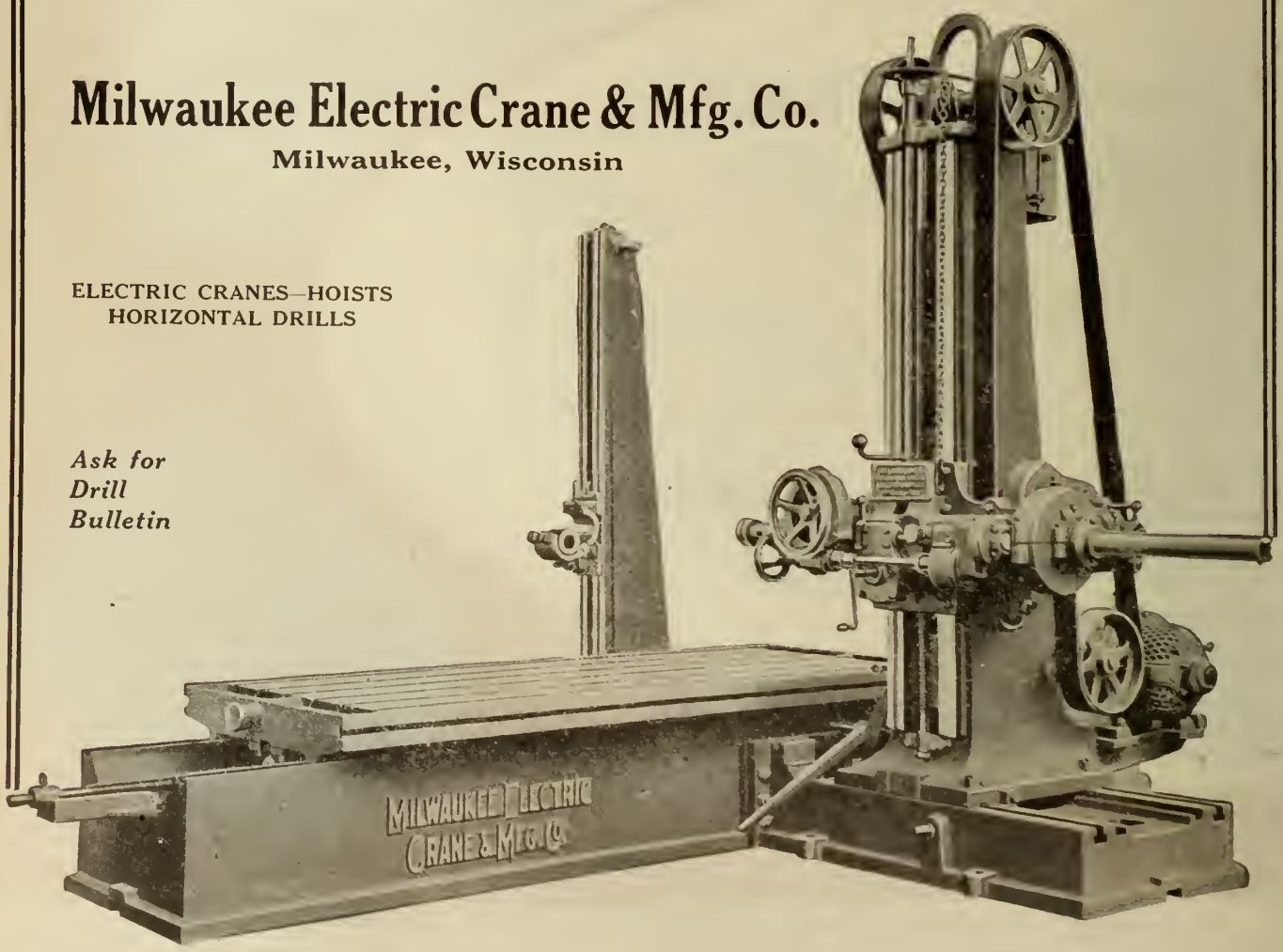
"MILWAUKEE"
Horizontal Drilling and Boring Machine

Speeds up work in the shop by saving time and simplifying operations.

Milwaukee Electric Crane & Mfg. Co.
Milwaukee, Wisconsin

ELECTRIC CRANES—HOISTS
HORIZONTAL DRILLS

Ask for Drill Bulletin



THE FOUNDRY GALT, ONT.

TRADE K–T IE A MARK

Do Your Castings Cost Too Much?

A rearrangement of your patterns might cut their cost 25%; a different method of molding them might double your production at no increase in molding cost. *We can advise you* and we have expert metal and wood patternmakers who are able to make any changes that may commend themselves to you.

If you need some new Patterns

send us a sample, blueprint or sketch, and ask for our advice. It won't cost you anything. If our advice is good and commends itself to you, it is only fair to assume that our work will be equally satisfactory, and we need the work as badly as you need the patterns.

We are in a position to do turning, boring, drilling or other semi-finishing operations on castings supplied by us.

ASK US

STEEL TUBING

FOR Agricultural Implements, Trolley Arms, Fence Posts, Bedsteads—and all kinds of manufacturing purposes. Reliable quality, uniform in size, 14 to 20 gauge, size ⅜″ to 2″ outside diameter.

STANDARD TUBE & FENCE COMPANY, LTD.
WOODSTOCK, ONT.



McKenzie Saw Table

A New and Better SAW TABLE

Saves Time and Space

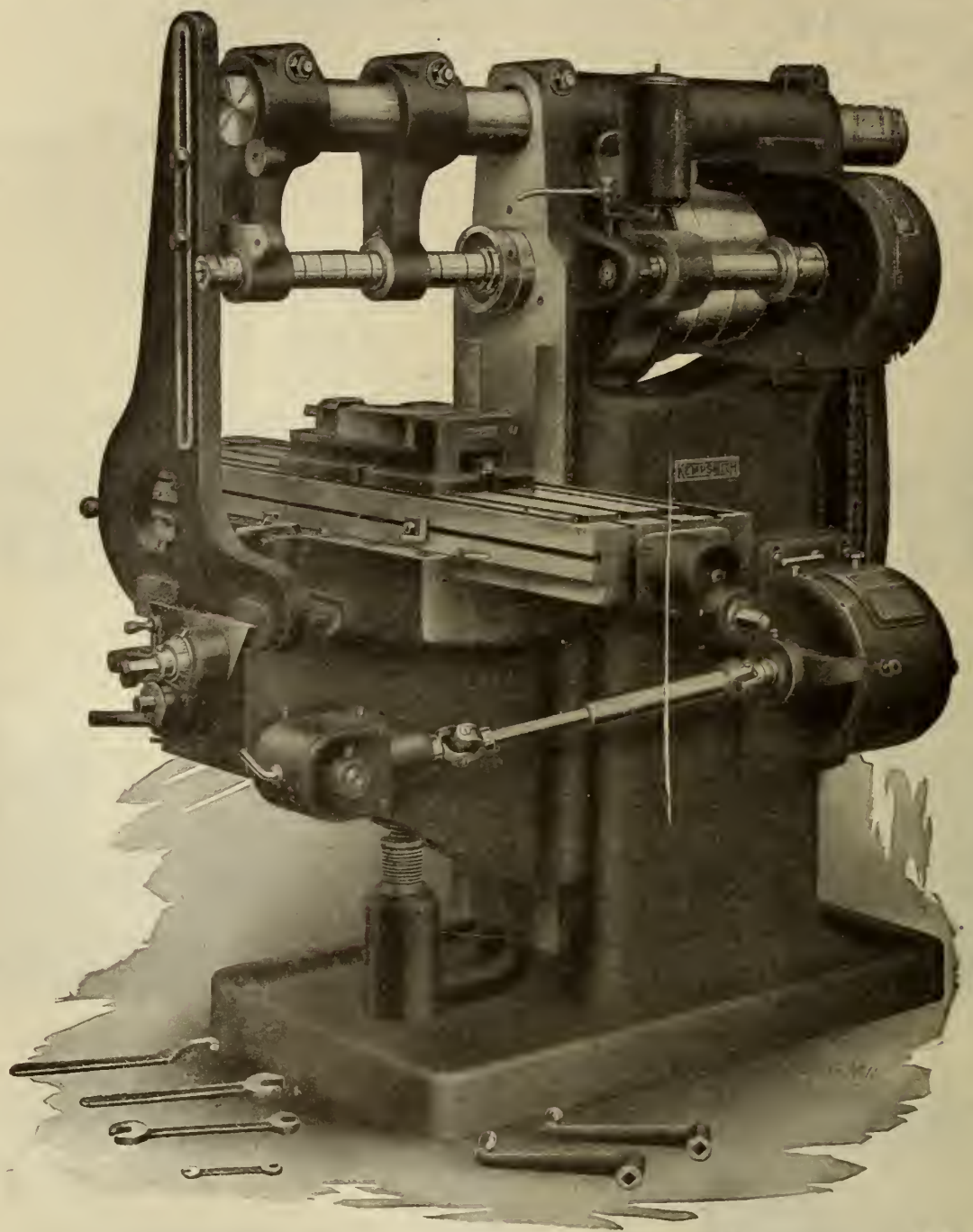
This New McKenzie Saw Table has several outstanding features which make it the best machine of its kind to buy. Does the same work as machines of larger dimensions, costs less, takes up less space and produces work faster. It is 23½″ x 30″. Distance from saw to ripping fence is 13″. Floor space 30″ x 36″. Furnished with belt, ripping fence, two mitre fences and 9″ saw.

Specially suitable for pattern shops, technical and manual training schools. **Write for prices and full particulars.**

THE D. McKENZIE MACHINE CO.
GUELPH, ONT.

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KEMPSMITH



KEMPSMITH No. 3 Plain Milling Machine

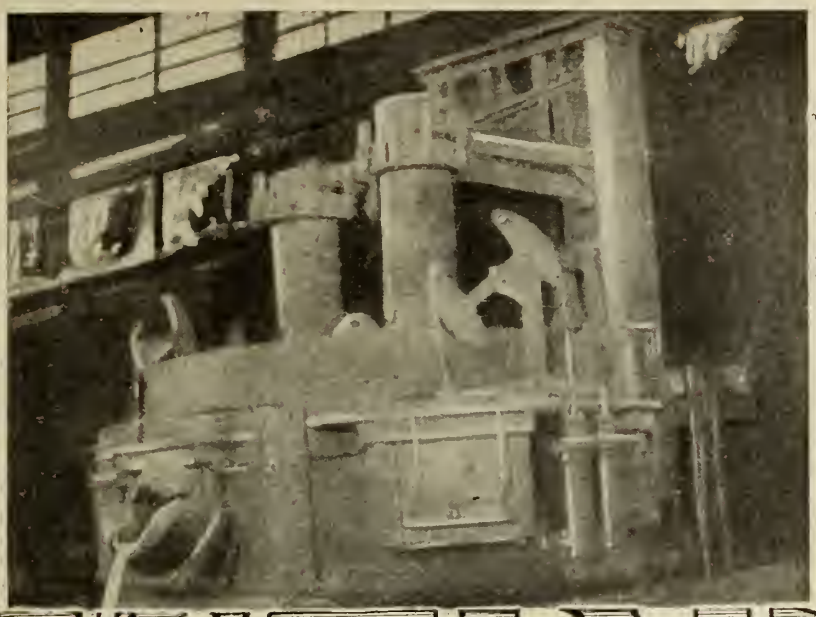
Double Back Geared

A heavy, powerful tool with double back gears and wide driving belt running on a three-step cone of large diameter. Our catalogue "B" describes and illustrates many notable features of the Kempsmith Miller. Write for a copy to-day.

THE KEMPSMITH MANUFACTURING CO.

MILWAUKEE, WIS., U.S.A.

FOREIGN REPRESENTATIVES:—The Geo. F. Foss Machinery & Supply Co., Limited, 305 St. James St., Montreal, Canada. Barandiaran & Co., 3 Alameda, San Sebastian, Spain. Bevan & Edwards Pty., Ltd., 117-29 King St., Melbourne, Australia. Edgar Bloxham, 12 Rue du Delta, Paris, France. Nielsen & Winther, Blegdamsveg 60, Copenhagen, Denmark. Parke & Lacey Co., Ltd., 60 Clarence St., Sydney, N.S.W., Australia. Selson Engr. Co., 19 Via Botro, Turin, Italy, and 85 Queen Victoria St., London, E.C., England. Spliethoff, Beeuvkes & Co., Leuvhaven, W. Z., 159, Rotterdam, Holland.



ELECTRITE

High Speed Steel

SEVERAL factors combine to make this high-speed steel a triumph of the steel-maker's art; Electric Furnaces—entirely infallible, automatically regulated, delivering the same result time after time.

Uranium — This rare element, cousin to Radium, effects a profound change in the texture and quality of the steel.

Added to these, the constant care and skill of years of steel-making experience make the result of each melt a foregone conclusion.

Latrobe Electric Steel Co.

LATROBE, PENN.

URANIUM

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A Simple Way to Cut the Cost of Travelling Salesmen

The salesmen who are compelled to fertilize, plow, sow, harrow and cultivate their fields, can not compete with the salesmen who spend the bulk of their time harvesting.

To keep a good salesman on the road to-day, costs more than ever before, and to deprive him of the advantage of Business Paper advertising is equivalent to demanding that he walk from city to city to save car fare. It's a net loss to both the salesman and the employer.

There is a Business Paper in each field of trade and industry which can do the preparatory work of cultivation more quickly, and at less cost than salesmen, thus multiplying the efficiency of the salesmen by permitting them to confine their efforts to harvesting.

There is no guesswork or theory about this—thousands of concerns are daily demonstrating its truth.

Business Paper advertising calls on the real buyers in your field and **your field only.** It is assured of an audience because it is contained in a paper edited wholly in the buyer's interest, which he needs, wants and pays for.

You who have discovered the benefits of specialization in production and in personal selling, need no argument to appreciate the opportunity for Specialized Advertising afforded by Business Papers.

What "A.B.P." Means to Advertisers.

Only papers subscribing to the Associated Business Papers' Standards of Practice are admitted to membership. These standards are unsurpassed in any field and cover every department of publishing in addition to certified circulation.

Maclean Publications All Members

The following is our list of trade and technical publications, all of which are members of the Associated Business Papers:

Weekly—
Hardware and Metal
Canadian Grocer
Financial Post
Druggists' Weekly
Canadian Machinery

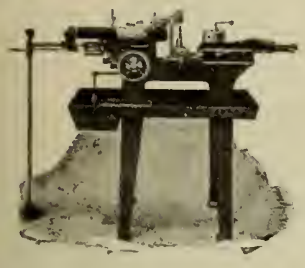
Semi-Monthly—
Maclean's Magazine
Farmers' Magazine
Power House
Sanitary Engineer

Monthly—
Dry Goods Review
Men's Wear Review
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Canadian Foundryman
Marine Engineering
Printer and Publisher
Canadian Motor, Tractor and Implement Trade Journal

The MacLean Publishing Company, Limited

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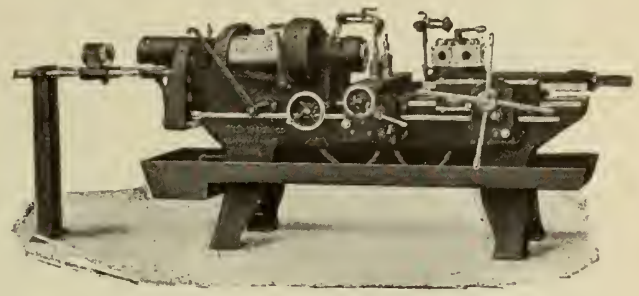
FOSTER PRODUCTION SERVICE



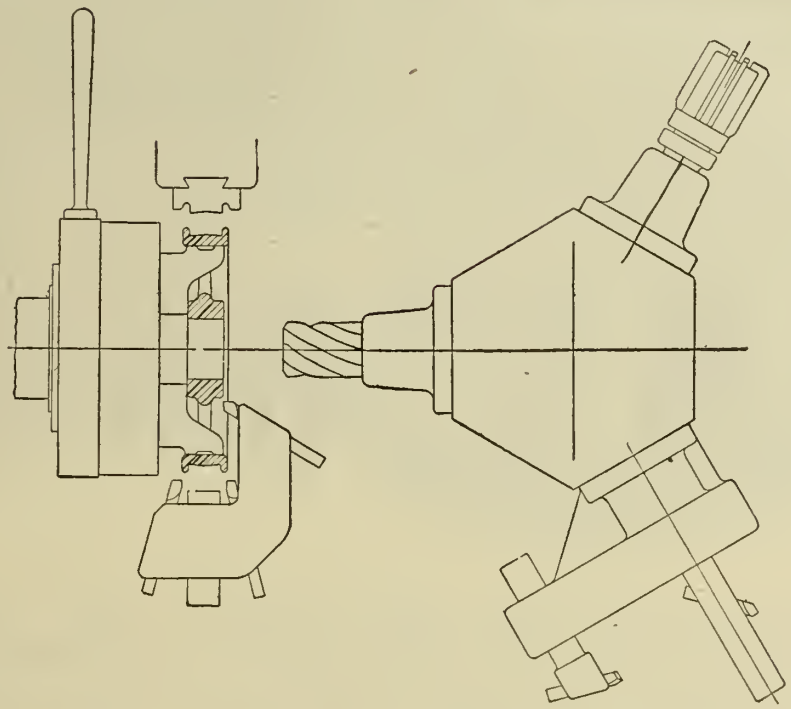
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SIX SIZES

No. 0 P. H. SCR. MCH.
No. 1 P. H. SCR. MCH.
No. 3 P. H. SCR. MCH.
No. 3 F. H. SCR. MCH.
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No. 7 F. H. SCR. M CH.



No. 7 F. H. SCR. MCH.



YOU WANT PRODUCTION---WE SELL IT

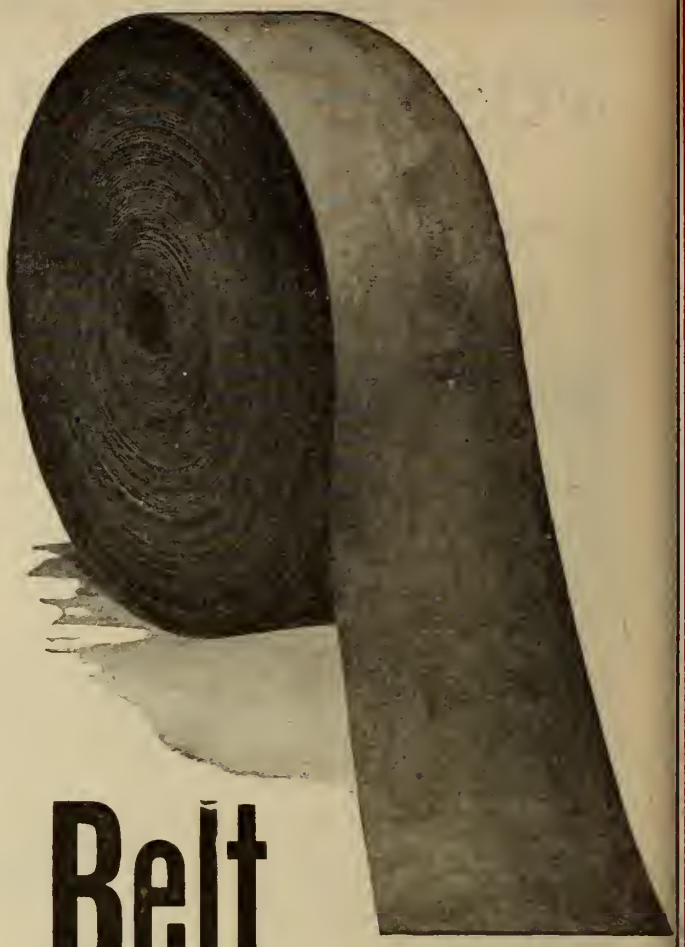
Production is an engineering proposition. It is a matter of the right equipment and the right method adapted to your work. The machine must be chosen for capacity, power and ease of operation. The tools must be designed for maximum production.

Our engineering staff is at your service. They are one of the *forces behind your production.*

LET US GET TOGETHER.

FOSTER MACHINE CO., ELKHART, IND.

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Where there's
difficult transmission
there's the place for a

"P.M.S." Belt

This trade-mark—"P.M.S."—is well known to Engineers and Plant Superintendents. It stands for the highest accomplishment in Belting Manufacture. We suggest that anyone having difficulty in power transmission due to dampness, heat, or mechanical awkwardness, should get the advice of one of our Belting Engineers. We are at your service.

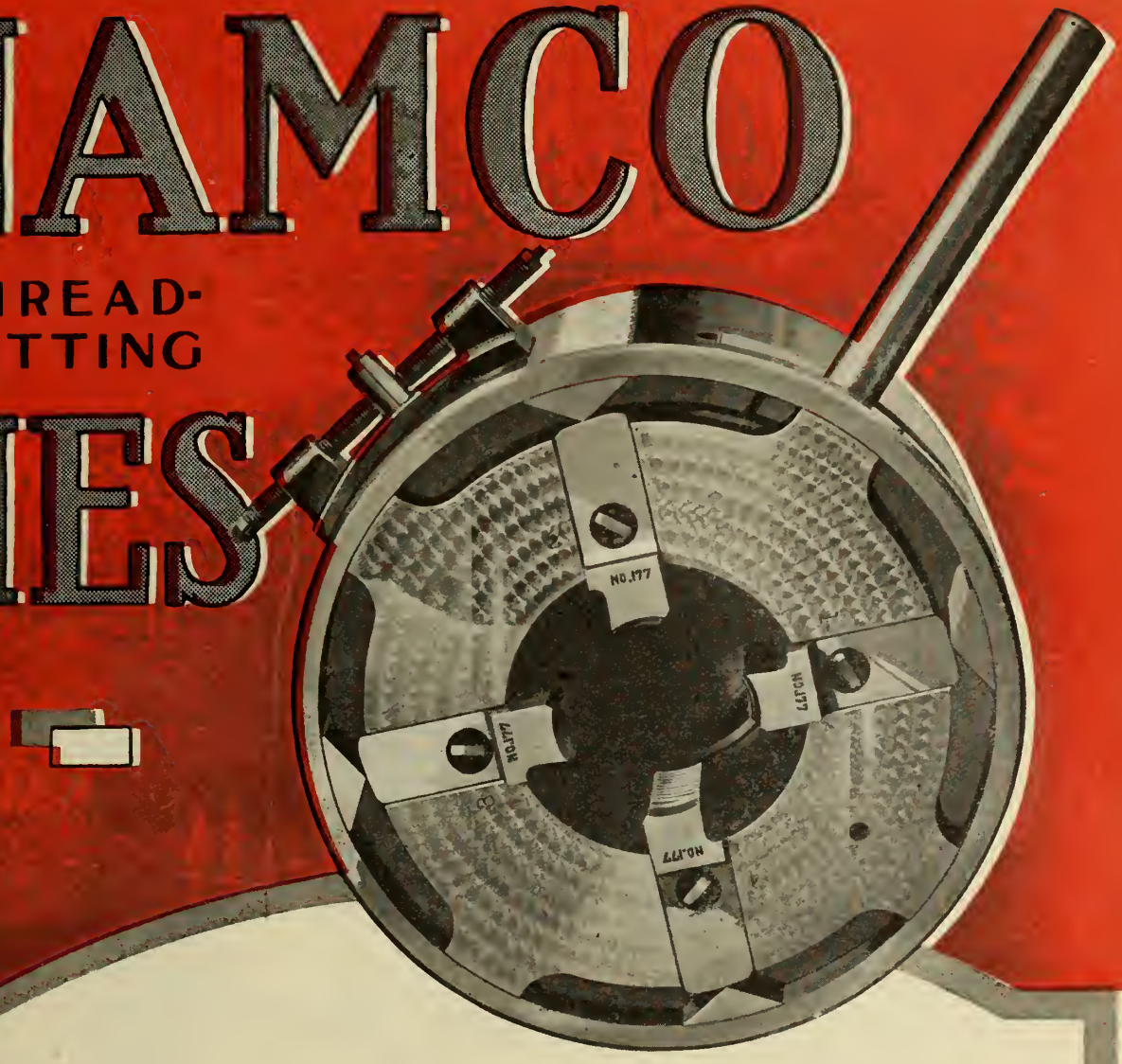
Gutta Percha & Rubber, Limited

Head Offices and Factory, Toronto

Branches in all Leading Cities of Canada

NAMCO

THREAD-CUTTING DIES



Used as Standard Equipment

NAMCO thread-cutting tools are used as standard equipment in hundreds of automotive and accessory plants throughout the country.

These tools are simply designed and strongly constructed; they give production of accurate and clean-cut threads on long and continuous runs.

There's a NAMCO DIE or TAP for practically every threading requirement. It costs you nothing to investigate.

Write for our new book—"DIES and TAPS"

THE NATIONAL ACME COMPANY

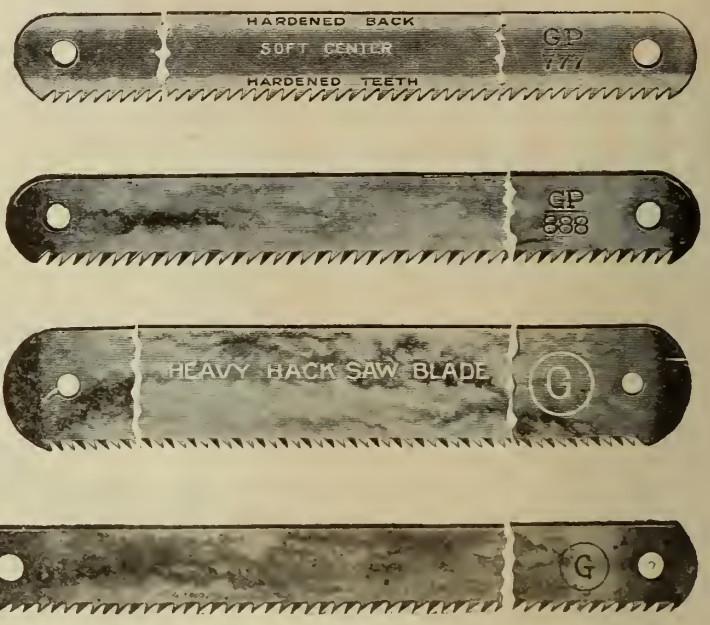
NEW ENGLAND PLANT WINDSOR, VT. **CLEVELAND, O.** CANADIAN SCREW PLANT MONTREAL, P.Q.

BRANCH OFFICES: NEW YORK, BOSTON CHICAGO DETROIT BUFFALO
WAREHOUSES: NEW YORK AND CHICAGO Representatives in Principal Foreign Countries

Maker of Gridley Single and Multiple Spindle Automatics at Windsor, Vermont, and Acme Automatics, Threading Dies, Collapsing Taps and Screw-Machine Products at Cleveland, Ohio

GOODELL-PRATT
1500 GOOD TOOLS





Hack-Saw Blades

GOODELL-PRATT Hack-Saw Blades are made to do useful work. They are not made to pass some freak test, the like of which is never encountered in actual work.

A Different Blade for Every Purpose

Goodell-Pratt Hack-Saw Blades are good blades because of the good material and good workmanship put into them. They are tempered and designed to do the work they are intended for. If a blade is to saw thin steel tubing, that fact is kept in mind throughout the entire manufacture of the blade. Enough types of blades are made to allow any one to select just the blade needed for the work in hand.



Why They Are So Good

The best material, skilful workmanship and approved designing fit Goodell-Pratt Hack-Saw Blades to stand up under severe usage. They possess the same high quality that has made the 1500 Goodell-Pratt Tools famous the world over.

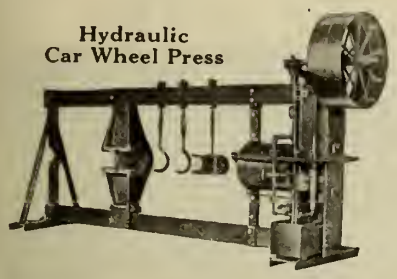
Send for a complete pocket catalog of these hack-saw blades and the other 1500 Goodell-Pratt Tools

GOODELL-PRATT COMPANY Greenfield, Mass., U. S. A.

LOURIE HYDRAULIC PRESSES

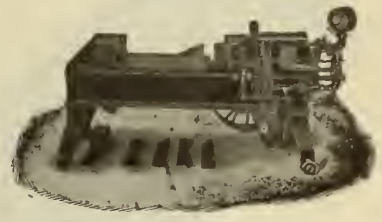
For Every Purpose Requiring Pressure

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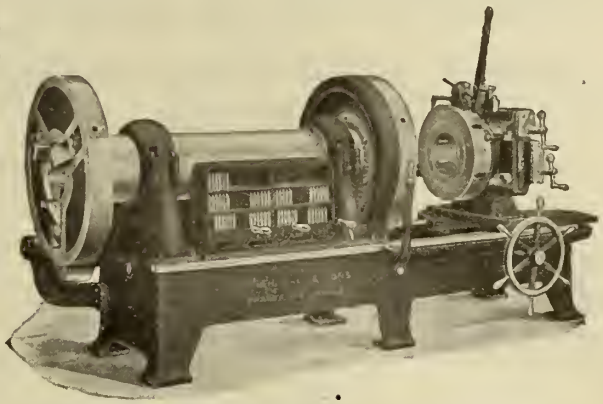
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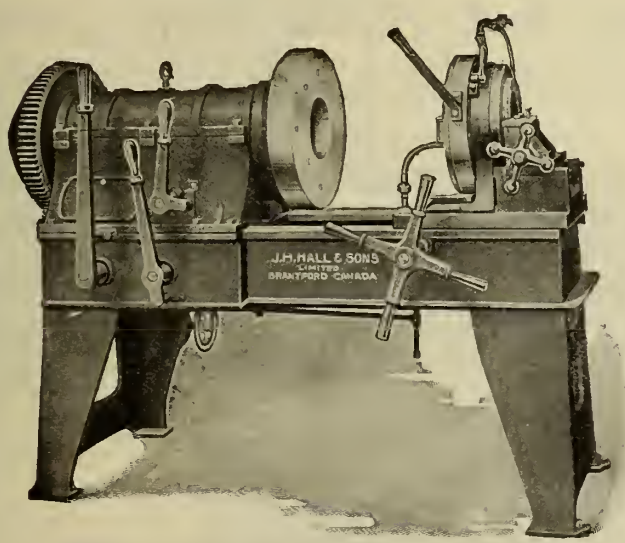
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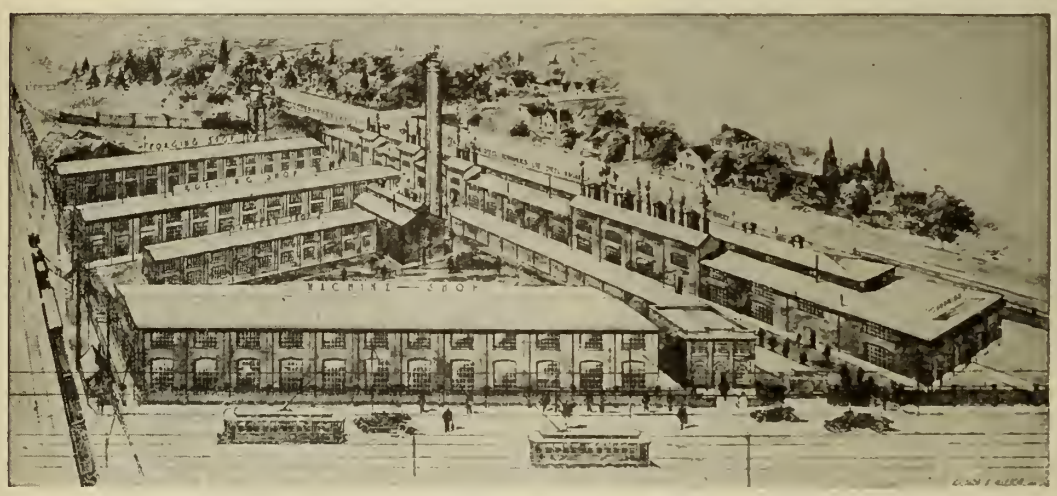
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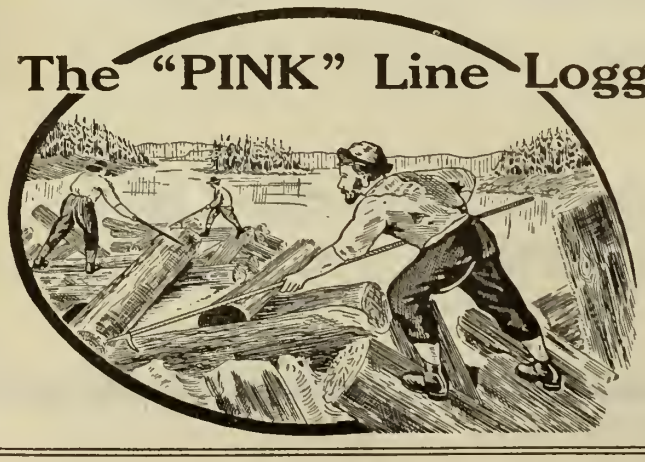


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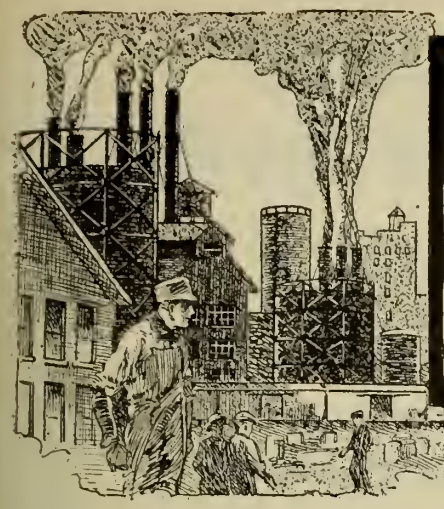
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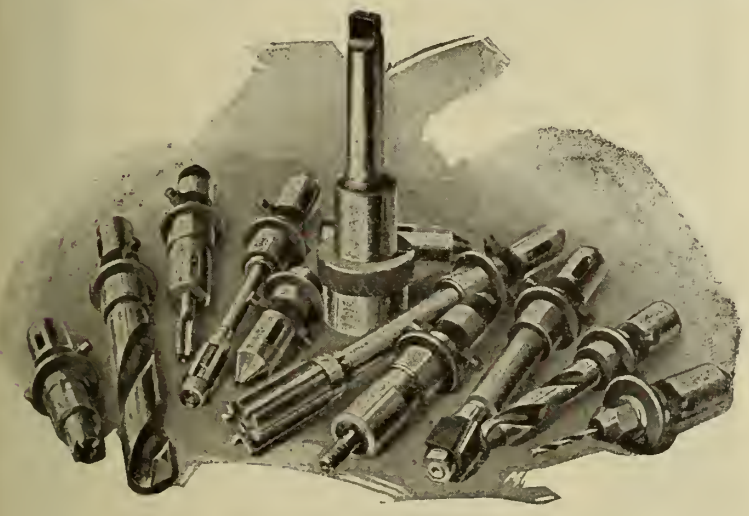
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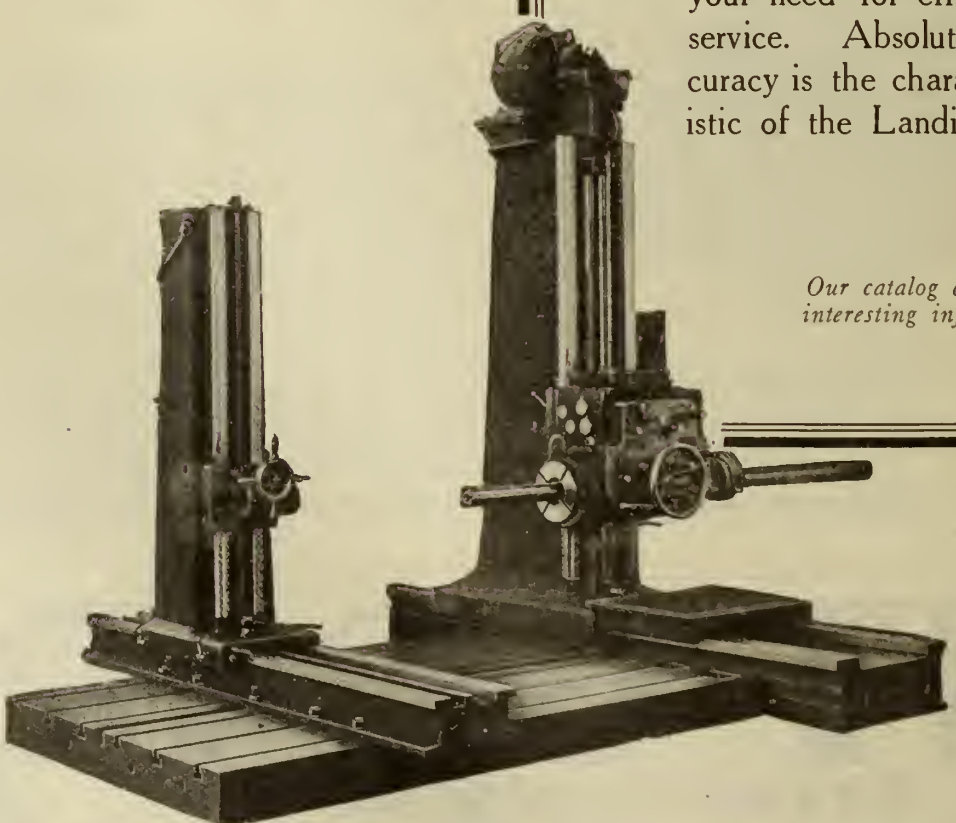
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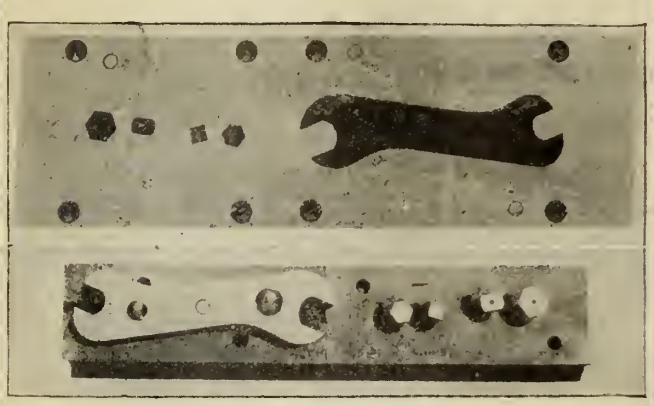
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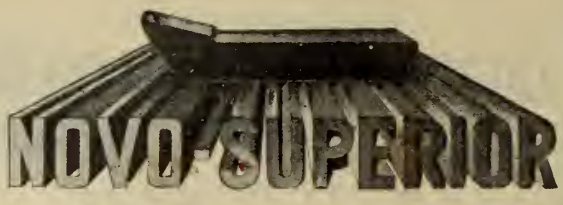
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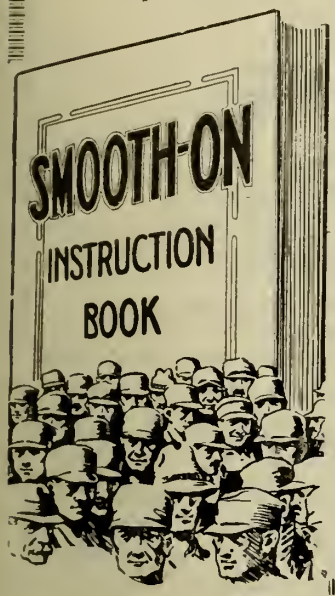
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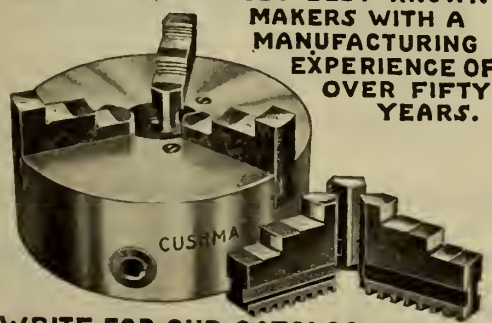
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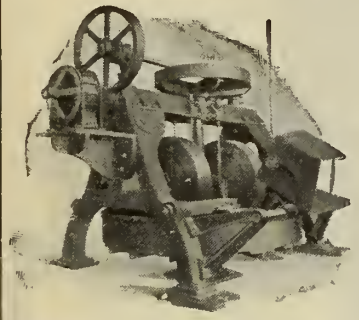
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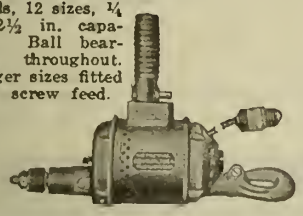
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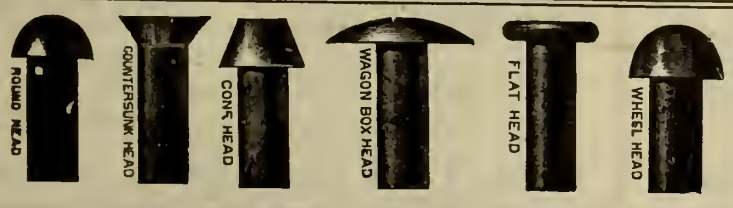
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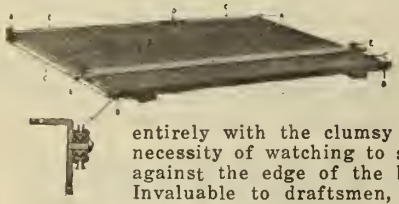
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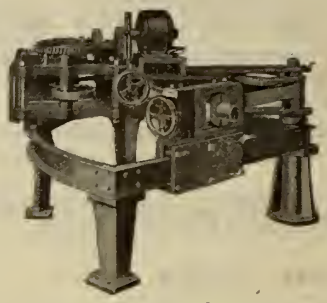


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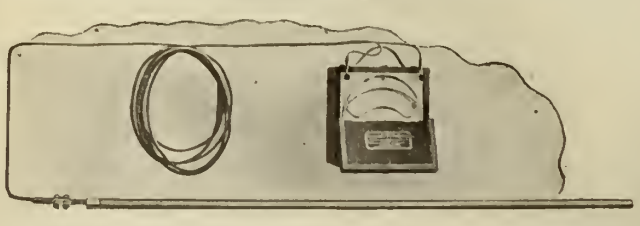
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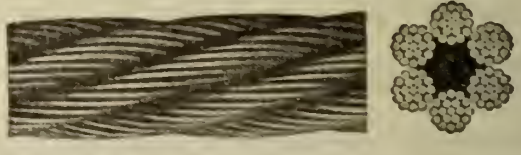
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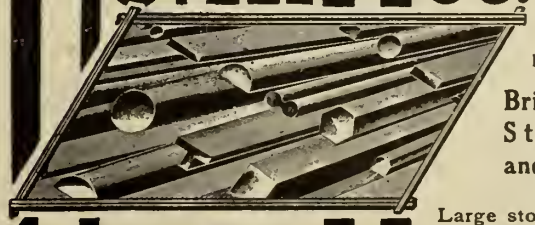
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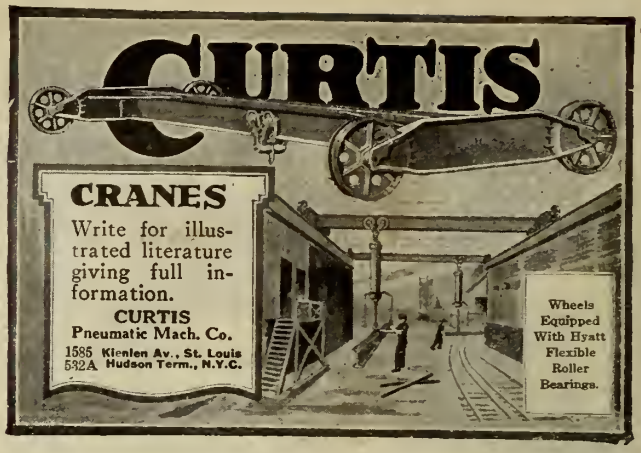
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Canada Electric Castings, Ltd., Orilla, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co., Ltd., Orilla, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.

CARRIERS COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll.
Alexander Fleck Ltd., Ottawa.
Tallman Brass & Metal Co., Hamilton

CASTINGS, BENCH LEG
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt, Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown, Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co., Ltd., Orilla, Ont.
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
Interantional Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.
McFarlane Engineering Ltd., G. W., Paris, Ont.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd., Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Morrow Screw & Nut Co., J., Ingersoll.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machinery Co., Toronto.
Lyman Tube & Supply Co., Montreal, Q.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.
Renold of Canada, Ltd., Montreal.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
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Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Renold of Canada, Ltd., Montreal.
Williams Mchy. Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N. Y.
Glasgow, N.S.
Renold of Canada, Ltd., Montreal.

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Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Ltd., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Labatory, Ltd., Toronto.

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, COLLET, AIR
Petrie, Ltd., H. W., Toronto.
Williams Mchy. Co., A. R., Toronto.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford
Foss Mchy. & Sply Co., Montreal.
Gardner, Robt. & Son, Montreal.
Garlock-Walker Machinery Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Herbert, Ltd., Alfred, Toronto, Ont.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Strelinger, Chas. A. Co., Windsor, Ont.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Warner & Swasey Co., Cleveland, O.
Williams Mchy. Co., A. R., Toronto, Ont.

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAY FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

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Oakley Chemical Co., New York, N.Y.

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The Dunbar Brothers Co., Bristol, Conn.

CLOCKS, WATCHMAN, PORTABLE
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CLOSETS
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CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

COAL CRUSHERS
Can. Link-Belt Co., Ltd., Toronto, Ont.

COAL HANDLING MACHINERY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
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Williams & Co., J. H., Brooklyn, N.Y.

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Sturtevant Co., B. F., Galt, Ont.

COMPOSITION INGOT
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Oakley Chemical Co., New York, N.Y.

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Atkins & Co., E. C., Hamilton, Ont.
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Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Superior Machinery Co., London, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
MacGovern & Co., Montreal, Que.

CONDUITS
Northern Electric Co., Ltd., Montreal, Que.

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CONNECTING ROD CUTTERS INTERCHANGEABLE
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Katie Foundry, Ltd., Galt, Ont.
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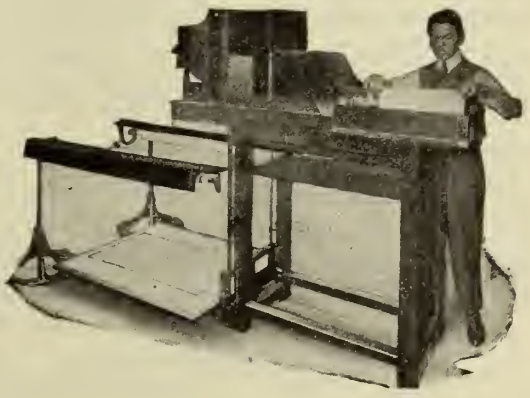
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Jones & Glassco, Montreal, Que.

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Puro Sanitary Drinking Fountain Co. Haydenville, Mass.

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Dom. Steel Products Co., Ltd., Brantford
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Can. Blower & Forge Co., Kitchener.

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Swan & Finch, Inc., 165 Broadway.

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Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Eclipse Counterbore Co., Ltd., Walkerville,
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.

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Eclipse Counterbore Co., Ltd., Walkerville, Ont.

COUNTERBORES, INVERTED, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

COUNTERSHAFTS
Almond Mfg. Co., Ashburnham, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Baird Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., Ltd., A. R., Montreal
Williams Mchy Co., A. R., Toronto.

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Bernard Industrial Co., The A., Fortierville, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto.

COUPLINGS, RAPID HOSE
Ont. Machinery & Supply Co., Ltd., Montreal, Que.

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Garlock-Walker Machinery Co., Toronto.

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Hanna & Co., M. A., Cleveland, O.

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Cleveland Pneumatic Tool Co. of Canada, Toronto.

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Gardner, Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago

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Can. Link-Belt Co., Ltd., Toronto, Ont.
Northern Crane Works, Walkerville.

ELECTRIC
Volta Manufacturing Co., Welland, Ont.

CUPS, OIL
Can. Winkley Co., Ltd., Windsor, Ont.

COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.

CRANES, GRAVITY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

CRANE RUNWAYS
MacKinnon Steel Co., Sherbrooke, Que.

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Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, LOCOMOTIVE
Brown Hoisting Machinery Co., Cleveland, Ohio.
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CRANES, GOLLIATH, PNEUMATIC AND PORTABLE
Brown Hoisting Machinery Co., Cleveland, Ohio.
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CRANES, PILLAR
Brown Hoisting Machinery Co., Cleveland, Ohio.

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Aikenhead Hardware Co., Toronto, Ont.
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy. Co., A. R. Toronto, Ont.

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Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Oliver Engineering Co., Montreal.

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Can. Found'n & Forgings Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.

CRANK PIN TURNING MACHINE
Herbert, Ltd., Alfred, Toronto, Ont.

CRIMPS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass.

CRUSHERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.

CUPOLAS
Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.

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Bowser Co., Ltd., S. F., Toronto, Ont.

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See Bolt Cutters.

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Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto

CUTTER HEADS
Oliver Machinery Co., Grand Rapids, Mich.

CUTTERS, PIPE (See Pipe Cutters)

CUTTERS, HIGH SPEED
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CUTTERS, MILLING
Butterfield & Co., Rock Island, Que.
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Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Sply. Co., G. E., Montreal.
Garvin Machine Co., New York.
Ingersoll Mache. Co., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
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CUTTER RELIEVING MACHINES
Cleveland Milling Machine Co., Cleveland

CUTTING-OFF MACHINES
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Atkins & Co., E. C., Hamilton, Ont.
Bertram & Sons Co., John, Dundas.
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Strelinger, Chas. A. Co., Windsor, Ont.
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Swedish Crucible Steel Co., Windsor.

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Ford-Smith Machine Co., Hamilton, Ont.

REHUMIDIFYING
B. F. Sturtevant Co., Galt, Ont.

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Dominion Bridge Co., Montreal.
Hepburn Co., Ltd., J. T., Toronto, Ont.
Morris Crane & Hoist Co., Sherbrook.

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Furniss, Clarke & Co., Montreal, Que.

DIAMOND TOOLS
Can. Desmond-Stephan Mfg. Co., Hamilton.
Ford-Smith Machine Co., Hamilton, Ont.
Furniss Clark & Co., Montreal, Que.
Joyce-Koebel Co., Inc., New York City
Wheel Trueing Tool Co., Detroit.
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Joyce Koebel Co., Inc., New York, N.Y.
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Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.

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Fisher Motor Co., Ltd., Orillia, Ont.
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Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros. of Can., Galt, Ont.
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Crescent Mche. Co., Ltd., Montreal, P.Q.
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Brown, Boggs Co., Hamilton, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
Herbert Ltd., Alfred, Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Jones & Lamson, Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Brothers of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, DROP FORGE.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, METAL STAMPING
Ackworthie Ltd., J., Birmingham, Eng.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall, Galt, Ont.

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Crescent Machine Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros. of Can., Galt, Ont.

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Garvin Machine Co., New York.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.
Pratt & Whitney Co., Dundas, Ont.
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DIES FOR MACHINES
Ackworthie Ltd., J., Birmingham, Eng.
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que.
Landis Machine Co., Waynesboro, Pa.
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Greenfield Tap & Die Corp., Greenfield, Mass.
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Herbert, Ltd., Alfred, Toronto, Ont.
Landis Machine Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit.
Wells Brothers Co. of Can., Galt, Ont
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.

DIE FILING MACHINES
Oliver Mach. Co., Grand Rapids, Mich

DIE STEEL, HOT AND COLD WORK
Armstrong-Whitworth of Can., Montreal
Atkins & Co., Ltd., Wm., Sheffield, Eng
Marshall, Son & Bunney, Toronto.
Firth & Sons, Thos., Montreal, Que.

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Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Wells Bros. Co. of Can., Galt, Ont.

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Ackworthie Ltd., J., Birmingham, Eng.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Globe Engineering Co., Hamilton, Ont.
Stoll Co., D. H., Buffalo, N.Y.

DIES, SCREW AND THREAD
Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros., Co., of Can., Galt, Ont

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Graton & Knight Mfg. Co., Worcester, Mass.

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Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sturtevant Co., B. F., Galt, Ont.

DRAINAGE FITTINGS
Crane, Ltd., Montreal, Que.

DRAWING INSTRUMENTS
Hughes, Owens Co., Ltd., Montreal, Que.

DRAWING OFFICE SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

DRESSERS, GRINDING AND EMERY WHEEL
Atkins & Co., E. C., Hamilton, Ont.
Can. Desmond-Stephan Mfg. Co., Hamilton
Dominion Abrasive Co., Ltd., Mimico, Ont
Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont

DRILL PRESSES
Can. Blower & Forge Co., Kitchener.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
U. S. Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto.

DRILL RODS
Atkins & Co., Ltd., Wm., Sheffield, Eng
Lincoln Electric Co. of Canada, Ltd. Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Swedish Steel & Importing Co., Ltd., Montreal.

DRILLING MACHINES, GANG
Bilton Mach. Tool Co., Bridgeport, Conn
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Silver Mfg. Co., Salem, Ohio.
Strelinger, Chas. A. Co., Windsor, Ont.

DRILLING MACHINES, LOCOMOTIVE AND MULTIPLE SPINDLE
John Bertram & Sons Co., Dundas
Bilton Mach. Tool Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Mach. Co., Toronto.
Garvin Machine Co., New York.
Hoefer Mfg., Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
Nat. Automatic Tool Co., Richmond, Ind.
Niles-Bement-Pond Co., New York.
Rockford Drilling Mach Co., Rockford, Ill
Strelinger, Chas. A. Co., Windsor, Ont.

DRILLING MACHINES, RADIAL AND TURRET
John Bertram & Sons Co., Dundas.
Canadian Fairbanks-Morse Co., Montreal
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Herbert, Ltd., Alfred, Toronto, Ont.
Henry & Wright Mfg. Co., Hartford,
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLING MACHINES, SENSITIVE
Bilton Mach. Tool Co., Bridgeport, Conn.
Canadian Fairbanks-Morse Co., Montreal
Canadian Machinery Corp., Galt, Ont.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Mach. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert, Ltd., Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
United States Mach. Tool Co., Cincinnati
Williams Mchy Co., A. R., Toronto, Ont.

DRILLING MACHINES, UPRIGHT AND HORIZONTAL
John Bertram & Sons Co., Dundas.
Garlock-Walker Mach. Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.
Canada Mach. Corp., Galt, Ont.
Garvin Machine Co., New York.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mach. Co., Toronto, Ont.
Herbert, Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Nat. Automatic Tool Co., Richmond, Ind.
Rockford Drilling Mach. Co., Rockford, Ill
Niles-Bement-Pond Co., New York.

30 Times Faster Than Ordinary Vises

THIS Columbian Quick-Acting Vise, with a jaw opening of 6 inches, can be opened the full length of the screw in ½ of a second. It takes *30 times as long* to rotate the handle and open an ordinary vise of the same size.

This new vise is an addition to the many other types of machinists' vises already included in the Columbian line. It is extremely simple, there are no complicated parts to get out of adjustment. A slight pressure of the trigger with the forefinger releases the screw and allows the beam to slide freely in either direction. Made in stationary and swivel base types; 7 sizes from 3 to 7 inch jaws, opening from 4½ to 12 inches. The jaw faces are removable and may be replaced with specially shaped jaw faces.

The new Quick-Acting Vise, however, is a highly specialized vise designed for machine shops in which a great many similar pieces pass continuously through the same operation. On such work as this, in an accurately timed test, an operation requiring two settings in the vise was done in an ordinary vise in 24 seconds. With a Columbian Quick-Acting Vise the same operation was done in 15 seconds.

This is a saving of 37½ per cent.

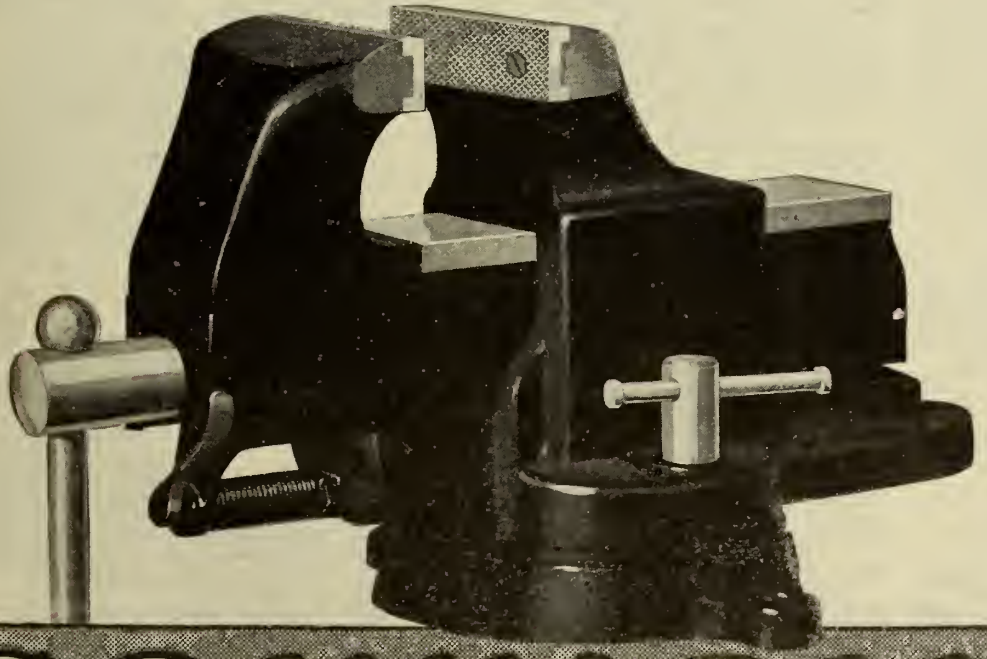
Like all Columbian machinists' vises this Quick-Acting Vise is made of malleable iron and is twice as strong as any cast iron vise of the same rating. The famous Columbian Sledge-Test proves this conclusively.

Columbian Hardware Division

of The Consolidated Iron-Steel Mfg. Co.

World's largest makers of vises and anvils

CLEVELAND



COLUMBIAN

Sledge-Tested VISES

If interested tear out this page and place with letters to be answered.

Silver Mfg. Co., Salem, Ohio.
Strelinger, Chas. A. Co., Windsor, Ont.
A. R. Williams Machinery Co., Toronto.

DRILLING MACHINES, SPECIAL
Hoefer Mfg. Co., Freeport, Ill.

DRILLING POSTS
Aikenhead Hardware Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Silver Mfg. Co., Salem, Ohio.

DRILLS, BENCH
Aikenhead Hardware Co., Toronto.
Can. Blower & Forge Co., Kitchener.
Can. Fairbanks-Morse Co., Montreal.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Machinery Co., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

DRILLS, BLACKSMITH AND BIT STOCK
Aikenhead Hardware Co., Toronto, Ont
Butterfield & Co., Inc., Rock Island, Que.
Can. Blower & Forge Co., Kitchener,
Cleveland Twist Drill Co., Cleveland.
Geo. F. Foss Mch. & S'ply Co., Montreal
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Can., Walkerville

DRILLS, CENTRE
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilt Twist Drill Co., of Can., Walkerville

DRILLS CORE, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

DRILLS, CARBON
Atkins & Co., Ltd., Wm., Sheffield, Eng
Butterfield & Co., Inc., Rock Island, Que.
Marshall, Son & Bunney, Toronto,
John Morrow Screw & Nut Co., Ingersoll

DRILLS, ELECTRIC, CORNER
Holden Co., Ltd., Montreal, Que.

DRILLS, ELECTRIC, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
Cincinnati Electrical Tool Co., Cincinnati
Geo. F. Foss Mch. & S'ply Co., Montreal
Haskins Co., R. C., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pilot Steel & Tool Co., Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
Strelinger Co., C. A., Windsor, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
A. R. Williams Mach. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, HAMMER
Samuel Osborne, Ltd., Montreal, P.Q.

DRILLS, EMERY
Garlock-Walker Mach. Co., Toronto, Ont.

DRILLS, HIGH SPEED TWIST
Aikenhead Hardware Co., Toronto, Ont.
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal
H. A. Drury Co., Montreal.
Geo. F. Foss Mch. & S'ply Co. Montreal
Herbert, Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Osborne, Samuel, Montreal, P.Q.
Pratt & Whitney Co., Dundas, Ont.
Petrie, H. W, Toronto.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Strelinger Co., Chas. A., Windsor, Ont.
Taylor J. A. M., Stair Bldg., Toronto.
Wilt Twist Drill Co. of Can., Walkerville
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, OIL TURE
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

DRILLS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Williams Mchy Co, Ltd., A. R., Montreal
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, PNEUMATIC CORNER
Can Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Chicago.

DRILLS, RATCHET AND HAND
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

DRILLS, ROCK
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
The Foss Mchy. & Supply Co., Montreal.
Holden Co., Ltd., Montreal, Que.
Samuel Osborne Ltd., Montreal, P.Q.
Strelinger, Chas. A. Co., Windsor, Ont.
A. R. Williams Machy. Co., Toronto.

DRILLS, SQUARE & HEXAGON
Globe Engineering Co.

DRILLS, TRACK
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Holden Co., Ltd., Montreal, Que.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

DRINKING FOUNTAINS, SANITARY
Crane, Ltd., Montreal, Que.
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

DRIVES, CHAIN
See Belting, Chain.

DRIVING TOOLS
The Thos. Pink Co., Ltd., Pembroke, Ont.

DRY CLEANING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

DRYERS, SAND
Lyman Tube & Supply Co., Montreal, Que.

DRYING APPLIANCES
Baird Machine Co., Bridgeport, Conn.
Sturtevant Co., B. F., Galt, Ont.
W. S. Rockwell Co., New York, N.Y.

DRUM CONTROLS
Volta Manufacturing Co., Welland, Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.

DUST HANDLING EQUIPMENT
Sturtevant Co., B. F., Galt, Ont.

DUST SEPARATORS
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

DYNAMOS AND ELECTRICAL SUPPLIES
Canadian Fairbanks-Morse Co., Montreal.
MacGovern & Co., Montreal, Que.
Strelinger Co., Chas. A., Windsor, Ont.
A. R. Williams Machy. Co., Toronto.

ELECTRICAL SUPPLIES
Lyman Tube & Supply Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal Que

ELECTRIC FURNACES
Electric Furnace Construction Co., Philadelpria, Pa.
Volta Manufacturing Co., Welland, Ont.

EECTRIC FURNACE REGULATORS, WINCHES, ROOF COOLERS AND ELECTRODE HOLDERS
Volta Manufacturing Co., Welland, Ont.

ELECTRIC HOISTS, STATIONARY AND MONO RAIL
Canadian Link-Belt Co., Ltd., Toronto,
Volta Manufacturing Co., Welland, Ont.

ELECTRIC MOTORS
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
Volta Manufacturing Co., Welland, Ont.

ELECTRIC TRUCKS
Cowan Truck Co., Holyoke, Mass.

ELEVATOR, ENCLOSURES
Volta Mfg. Co., Welland, Ont.
Canada Wire & Iron Goods Co., Hamilton

ELEVATOR WEIGHTS
Katie Foundry, Galt, Ont.

ELEVATORS AND BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.

ELEVATING AND CONVEYING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Petrie, Ltd., H. W., Toronto.

EMBOSSING PRESSES
Dom. Steel Products Co., Ltd., Brantford.
Oliver Machinery Co., Grand Rapids, Mich

EMERY GRINDERS (PNEUMATIC)
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.

EMERY CLOTH
Atkins & Co., E. C., Hamilton, Ont.

EMERY PAPER
Atkins & Co., E. C., Hamilton, Ont.

EMERY AND EMERY WHEELS
Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford, Canada.
Tue Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.

EMERY WHEEL DRESSINGS
Dominion Abrasive Co., Ltd., Mimico, Ont.
Wheel Trueing Tool Co., Windsor Ont.

ENAMELWARE
Crane, Ltd., Montreal, Que.

END MILLS
John Morrow Screw & Nut Co., Ingersoll

ENGINEERS—INDUSTRIAL CLEANING (Free Consultation)
Oakley Chemical Co., New York, N.Y.

ENGINEERS
Samuel Osborne (Canada) Ltd., Montreal

ENGINES, STEAM, GAS, GASOLINE
Furniss, Clarke & Co., Montreal, Que.
Canadian Fairbanks-Morse Co., Montreal.
Holden Co., Ltd., Montreal, Que.
Johnson Mach. Co., Carlyle, Manchester, Conn.
MacGovern & Co., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

ENGINES, HORIZONTAL AND VERTICAL
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Johnson Mach. Co., Carlyle, Manchester, Conn.
Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

ENGINES, OIL
Holden Co., Ltd., Montreal, Que.
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.

ENGINES, HEAVY OIL, DIESEL TYPE
Dom. Steel Products Co., Ltd., Brantford
Holden Co., Ltd., Montreal, Que.

ENGINES, MARINE
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

ENGINES, STATIONARY, FUEL, OIL, GAS OR GASOLINE
Holden Co., Ltd., Montreal, Que.

ESCUTCHEON PINS
Parmenter & Bulloch, Gananoque, Ont.

EXHAUST HEADS AND HOODS
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Sturtevant Co., B. F., Galt, Ont.

EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
Can. Driver-Harris Co., Walkerville, Ont.

EXTRACTORS, TAP
Walton Co., The, Hartford, Conn.

EYE BOLTS AND NUTS
Can. Foundries & Forgings, Ltd., Welland, Ont.

EYE PROTECTORS
Standard Optical Co., Geneva, N.Y.

FACTORY LOCATIONS
City of St. Johns, Quebec.

FACTORY SITES
City of St. Johns, Quebec.

FANS
Baird Machine Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

FENCE, IRON AND FACTORY
Can. Wire & Iron Goods, Hamilton, Ont.

FERRO-TUNGSTEN
Vanadium-Alloys Steel Co., Pittsburgh, Pa

FIBRE, RODS AND SHEETS
Diamond State Fibre Co., Bridgeport, Pa.

FILES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Wm., Sheffield, Eng.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Marshall, Son & Bunney, Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.

FILES, COMMUTATOR SLOTTING
Lyman Tube & Supply Co., Montreal, Que.

FILING MACHINES, BENCH AND MOTOR DRIVEN
Cochrane-Bly Co., Rochester, N.Y., U.S.A

FILTERING AND CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. Wire & Iron Goods, Hamilton, Ont.

FIRE BRICK
Elk Fire Brick Co., Hamilton, Ont.
General Combustion Co., Ltd., Montreal, Que.

FIRE CLAY
Elk Fire Brick Co., Can., Ltd., Hamil
General Combustion Co., Ltd., Montreal, Que.

FINISHING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.

FITTINGS, CAST IRON, SCREWED, FLANGED
Crane, Ltd., Montreal, Que.

FIXTURES
Brown Engineering Corp., Toronto, Ont.
Crescent Mchc. Co., Ltd., Montreal, Que.

FLAT SPRINGS
The Dunbar Brothers Co., Bristol, Conn

FLEXIBLE SHAFT EQUIPMENT
R. C. Haskins Co., Chicago, Ill.

FLOODLIGHTS, ELECTRIC
Holden Co., Ltd., Montreal, Que.
Northern Electric Co., Ltd., Montreal, Que

FLOTATION MACHINERY
Elec. Steel & Metals, Welland, Ont.

FLUMES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
William Hamilton Co., Peterboro, Ont.

FORGES, HAND PORTABLE
Hardware Co., Toronto, Ont.
Can. r & Forge Co., Kitchener.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.

FORGE TOOLS
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

FORGES, OIL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

FORGINGS
Mesta Machine Co., Pittsburgh, Pa.
Can. Found. & Forgings, Ltd., Welland.
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

FORGINGS, DROP, AUTOMOBILE AND LOCOMOTIVE FORGING AND WELDING
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamp'g Co., Walkerville.
Steel Co. of Canada, Ltd., St. Catharines.
Victoria Foundry Co., Ottawa.
Williams & Co., J. H., Brooklyn, N.Y.

FORGING MACHINERY
John Bertram & Sons Co., Dundas, Ont.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
National Machy. Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.

FORGINGS, SPECIAL
Armstrong-Whitworth of Can., Montreal.
Can. Found. & Forgings, Ltd., Welland.
Williams & Co., J. H., Brooklyn, N.Y.

FORMING
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FOUNDRY EQUIPMENT
Herbert Ltd., Alfred, Toronto, Ont.

FRICTION LEATHERS
Graton & Knight Mfg. Co., Montreal.

FRICTION SURFACE BELTING
Can. Consolidated Rubber Co., Montreal.

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Bowser Co., Ltd., S. F., Toronto, Ont.

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Bellevue Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Gen. Combustion Co. Can., Ltd, Montreal
Mechanical Eng'r'g Co., Three Rivers, Q.
W. S. Rockwell Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.

FURNACES, BLAST
Bellevue Industrial Furnace Co., Detroit.
W. S. Rockwell Co., New York, N.Y.
Toronto Iron Works, Ltd., Toronto.

FURNACES — BRASS MELTING
General Combustion Co., Ltd., Montreal.

FURNACES, ELECTRIC
Electric Furnace Construction Co., Philadelpria, Pa.

FURNACES, FORGING
Gen. Combustion Co. of Can., Ltd., Montreal.
W. S. Rockwell Co., New York, N.Y.

FUSE BOXES, STEEL
Dom. Forge & Stamp. Co., Walkerville.

FUSE PLUGS AND FUSES
Northern Electric Co., Ltd., Montreal Que

GALVANIZING FLUX
British Smelting & Refining Co., Ltd. Montreal, Que.

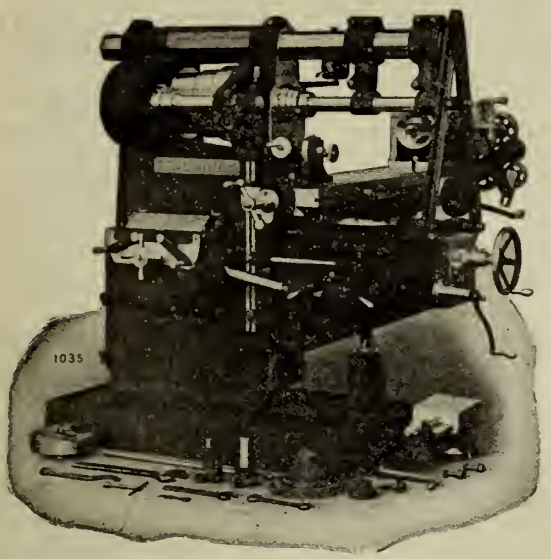
GANG PLANER TOOLS
Armstrong Bros. Tool Co., Chicago.

GAS AND STEAM ENGINES
Mesta Machine Co., Pittsburgh, Pa.

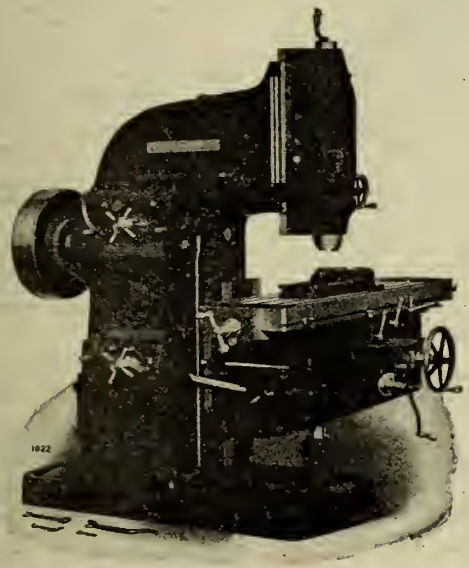
GASKETS, LEATHER, ETC.
Graton & Knight Mfg. Co., Montreal.
Holden Co., Ltd., Montreal, Que.

GASOLINE METERS
Bowser Co., Ltd., S. F., Toronto, Ont.

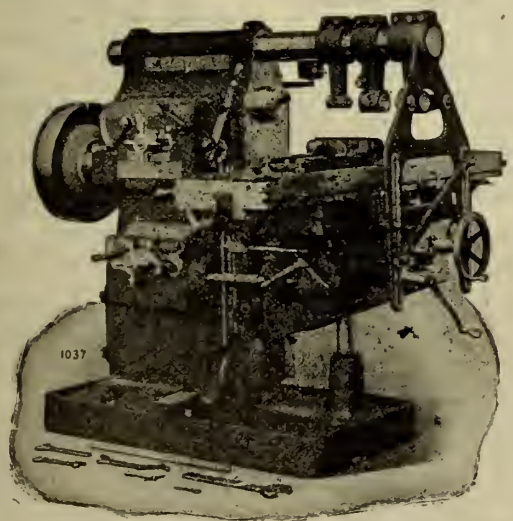
GASOLINE TANKS
Bowser Co., Ltd., S. F., Toronto, Ont.



One of our 5-cone Driven Universal Millers. We make 8 corresponding single pulley machines.



One of our five sizes of single pulley, vertical Millers.



One of our 8 high power single pulley plain Millers. We also make 4-cone driven plain machines.

THE Manufacturer who is looking for any one specific size and type of Milling Machine, can exactly satisfy his need from the line of Cincinnati Milling Machines. Included is every commercial size—from 18 in. table travel to 50 in. table travel—from 1 h.p. normal capacity to 20 h.p.—from 1,450 lbs. net weight to 11,000 lbs.—and between these two extremes, 27 sizes and styles of Horizontal Millers. In addition to that a full line of Vertical Millers and Automatic Manufacturing Millers.

You will grant that from such a complete line, you can fill your shop's needs in Millers as perfectly as a plug gauge fits its corresponding ring. A few of them are shown on this page. All of them have won the highest reputation everywhere. Complete details are given in our literature, which will be sent to anyone who is interested.

The Cincinnati Milling Machine Company

CINCINNATI, OHIO, U.S.A

H. W. PETRIE, LTD., Toronto

H. W. PETRIE OF MONTREAL, Limited 327 St. James St.

GENERAL SUPPLY CO., Winnipeg

HALLIDAY MACHINERY CO., Vancouver

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GASOLINE PUMPS, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

GAUGES
Crescent Mach. Co., Ltd., Montreal, P.Q.

GAUGES, CALIPERS
Williams & Co. J. H., Brooklyn, N.Y.

GAUGES, DIAL
Herbert, Ltd., Alfred, Toronto, Ont.

GAUGES, MERCURY COLUMN, DRAFT
Taylor Instrument Co., Rochester, N.Y.

GAUGES, HYDRAULIC
Taylor Instrument Co., Rochester, N.Y.

GAUGES, MANUFACTURERS, LIMIT, THREAD
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Can., Galt, Ont.

GAUGES, SNAP, THREAD AND CYLINDRICAL
C. E. Johanson, Inc., Toronto, Ont.

GAUGES, VACUUM AND PRESSURE
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Rochester, N.Y.

GAUGES, STANDARD
Brown Engineering Corp., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Crescent Mche. Co., Ltd., Montreal, Que.
Garvin Machine Co., New York.
C. E. Johanson, Inc., Toronto, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Hartford, Conn.
Strelinger, Chas. A. Co., Windsor, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto.
Wells Brothers Co. of Canada, Galt, Ont.

GEAR BLANKS
Can. Steel Foundries, Ltd., Montreal,
Dom. Found. & Steel, Hamilton, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

GEAR BLANKS, CAST
Katis Foundry, Galt, Ont.

GEAR BLANKS, RAWHIDE
Lyman Tube & Supply Co., Montreal, Que.

GEAR BOXES .REDUCTION
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEAR SHAPERS AND CUTTERS
Fellows Gear & Shaper Co., Springfield, V.

GEAR-CUTTING MACHINERY
Bilton Mach. Tool Co., Bridgeport, Conn.
Fellows Gear & Shaper Co., Springfield, V.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

GEAR-TESTING MACHINE
Gisholt Machine Co., Madison, Wis.

GEARS, CHAIN
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.
Renold of Canada Ltd., Montreal.

GEARS, COMPENSATING
Morse Chain Co., Ithaca, New York.
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, CUT, MORTISE, ANGLE, WORM
Can. Link-Belt Co., Toronto, Ont.
Diamond State Fibre Co., Bridgeport, Pa.
Dom. Steel Products Co., Ltd., Brantford.
Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Gardiner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Found., Ltd., Hull, Q.
Jones & Glasseo, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
Victoria Foundry Co., Ottawa.

GEARS, RAWHIDE
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough,
Jones & Glasseo, Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
A. R. Williams Machy. Co., Toronto.

GENERATORS, GEAR
Fellows Gear & Shaper Co., Springfield, V

GEARS, SILENT CHAIN
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, SPRING
Morse Chain Co., Ithaca, New York.

GEARS, SPUN, BENCH, SPIRAL
Brown & Sharpe Mfg. Co., Providence, R.I.

GENERATORS AND CONVERTORS
Northern Elec. Co., Ltd., Montreal, P.Q.

GENERATORS, MOTOR
MacGovern & Co., Montreal
Northern Elec. Co., Ltd., Montreal, P.Q.
Sturtevant Co., B. F., Galt, Ont.

GENERATORS, STEAM TURBO
Can Link-Belt Co., Ltd Toronto, Ont.
Holden Co., L. C., Montreal, Que.

GILDING
Brown's Copper and Brass Rolling Mills New Toronto.

GLUE HEATERS
Oliver Machinery Co., Grand Rapids, Mich

GLASSES, SAFETY
Willson & Co., Inc., T. A., Reading, Pa.

GRAPHITE
Aikenhead Hardware, Ltd., Toronto.
Rice Lewis & Son, Toronto.

GOGGLES
Standard Optical Co., Geneva, N.Y.

GRAB BUCKETS—CLAMSHELL and ORANGE PEEL
Canadian Link-Belt Co., Ltd., Toronto, Ont.

GRAVITY CARRIERS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
Morris Crane & Hoist Co., Ltd., Herbert
Niagara Falls, Ont.

GREASE CUPS, PRESSED STEEL, BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES (See Lubricants)

GRINDERS, AUTOMATIC KNIFE
Canada Machinery Corp., Galt, Ont.
Foss Mchry. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto

GRINDERS, AUTOMATIC SURFACE
La Salle Tool Co., La Salle, Ill.

GRINDERS, BENCH
Superior Machinery Co., London, Ont.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Can. Machinery Corp., Galt Ont
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Haskins & Co., R. C., Chicago, Ill.
Wisconsin Electric Co., Inc., Racine Wis
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Katie Foundry, Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec. Tool Co., Cincinnati.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co. A. R., Toronto, Ont.

GRINDERS, CUTTER
Brown & Sharpe Mfg. Co., Providence, R.I
Cincinnati Milling Mach. Co., Cincinnati.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Globe Engineering Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co., Worcester Mass.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd. H. W., Toronto.
Williams Mchy Co. A. R. Toronto, Ont.

GRINDERS, DIE AND CHASER
Haskins & Co., R. C., Chicago, Ill.
Landis Machine Co., Waynesboro, Pa.
National-Acme Co. Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., E. C., Hamilton, Ont.
Ford-Smith Mach. Co. Hamilton.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co. Worcester Mass.

GRINDERS, FLEXIBLE CASTING
Manhattan Machine & Tool Co., Grand Rapids, Mich

GRINDERS, DRILL
Aikenhead Hardware Co., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield,
La Salle Tool Co., La Salle, Ill.
Petrie, Ltd. H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co. A. R. Toronto, Ont.

GRINDERS, CYLINDER, INTERNAL
Brown & Sharpe Mfg. Co., Providence, R.I
Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield Mass.
Heald Machine Co. Worcester Mass.
Landis Tool Co., Waynesboro Pa.
Norton Co. Worcester, Mass
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co. A. R. Toronto, Ont.

GRINDERS, PORTABLE, ELECTRIC HAND, TOOL POST, FLOOR AND BENCH
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Mach. Co., Hamilton, Ont.
Haskins & Co., R. C., Chicago, Ill.
Garlock-Walker Machinery Co. Toronto.
Greenfield Machine Co., Greenfield, Mass.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
United States Elec. Tool Co. Cincinnati
Wisconsin Electric Co., Inc., Racine, Wis.
Williams Mchy Co. A. R. Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

GRINDERS, HOLE, HOLE AND AND DEEP HOLE
Barber Mchy. Co., Ltd. Toronto, Ont.
Bryant Chucking Grinder Co., Springfield, Vermont.
Heald Machine Co., Worcester, Mass.

GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co., Toronto.
Garlock-Walker Machinery Co., Toronto.
Heald Machine Co., Worcester, Mass.
Independent Pneumatic Tool Co., Chicago
MacGovern & Co., Montreal, Que.

GRINDERS, PROFILE
Cleveland Milling Machine Co., Cleveland.

GRINDERS, ROTARY SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Bristol Machine Tool Co., Bristol, Conn.
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, TOOL AND HOLDER
Armstrong Bros. Tool Co., Chicago.
Blount & Co., J. G., Everet, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

GRINDERS, UNIVERSAL, PLAIN
Manhattan Machine & Tool Co., Grand Rapids, Mich
Norton Co. of Canada, Ltd., Hamilton, Ont.
Norton Co. Worcester, Mass.
Williams Mchy Co. Ltd.: A. R., Montreal

GRINDERS, VERTICAL, SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Montreal.
Heald Machine Co., Worcester, Mass.
Herbert, Ltd., Alfred, Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester Mass.
Norton Co. of Canada, Ltd., Hamilton, Ont
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co. A. R. Toronto, Ont

GRINDING AND POLISHING MACHINES, PORTABLE, PNEUMATIC AND SPRING FRAME
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Elec. Tool Co., Cincinnati, O
Ford-Smith Mach. Co., Hamilton, Ont
Gardner & Son, Robt., Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass
Haskins & Co., R. C., Chicago, Ill
Hall & Sons, John H., Brantford, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Niles-Bement-Pond Co., New York, N.Y
Norton Co., Worcester, Mass.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
Wisconsin Electric Co., Racine, Wis.
Williams Mchy Co., A. R., Toronto Ont
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

GRINDING MACHINES, CAR WHEEL, CUTTER, CYLINDRICAL, CRANKSHAFT
Brown & Sharpe Mfg. Co. Providence, R.I
Norton Co. of Canada, Ltd., Hamilton, Ont.
Norton Co. Worcester Mass

GRINDING WHEELS
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford
Can. Fairbanks-Morse Co., Montreal.
Carborundum Co., Niagara Falls, N.Y.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Foss Mchy. & S'ply Co. G. F. Montreal
Norton Co. of Canada, Ltd., Hamilton, Ont.
Norton Co. Worcester, Mass.

GRINDING WHEEL DRESSER
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont
Norton Co. of Canada, Ltd., Hamilton, Ont.

GUARDS, WINDOW AND MACHINE
Canada Machinery Corp., Galt, Ont
Canada Wire & Iron Goods Co., Hamilton
Dennis Wire & Iron Works, London, Ont
B. Greening Wire Co., Hamilton, Ont.

GUTTERS AND SKYLIGHTS
H. H. Robertson Ltd., Sarnia, Ont

HACK SAW BLADES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont
Atkins & Co., Ltd., Wm., Sheffield, Eng
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Ford-Smith Machine Co., Hamilton, Ont
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Gunney, Toronto.
Norton Ralph B., Agent, Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Pilot Steel & Tool Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
L. S. Starrett Co., Athol, Mass.
Standard Machy. & Supplies, Montreal
Strelinger, Chas. A. Co., Windsor, Ont.
Victor Saw Works Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.
Williams Mchy Co. A. R. Toronto, Ont.

HANDLES, BALANCE, CRANK AND MACHINE
Williams & Co. J. H. Brooklyn, N.Y.

HANGERS, SHAFT
Can. Link-Belt Co. Ltd. Toronto, Ont

HACK SAW FRAMES
Aikenhead Hardware Co. Toronto.
Atkins & Co. E. C. Hamilton Ont.
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont
Garvin Machine Co., New York City.
Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto
Strelinger, Chas. A. Co., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.

HACK SAWS, POWER
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Foss Mchy. & S'ply Co., G. F., Montreal
Ford-Smith Machine Co., Hamilton.
Perfect Machine Co., Galt, Ont.
Starrett Co., L. S., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont

HAMMERS, FORGING
Nazel Eng. & Mach. Wks., Philadelphia

HAMMERS, ELECTRIC
Hoskins & Co., R. C., Chicago, Ill.

HAMMERS (DROP), MOTOR AND BELT DRIVEN
Beaudry & Co., Boston, Mass.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton.
Canada Machinery Corp., Galt, Ont.
High Speed Hammer Co., Rochester, N.Y
Jardine & Co., A. B., Hespeler, Ont.
Niles-Bement-Pond Co., New York, N.Y
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

HAMMERS, HELVE POWER
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

HAMMERS, CHIPPING, CAULKING, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, NAIL MACHINE
Rice Lewis & Son, Toronto, Ont.
United Hammer Co., Boston, Mass.

HAMMERS, POWER
Nazel Eng. & Mach. Wks., Philadelphia

HAMMERS, STEAM
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.

HAND PLANERS
Oliver Mchry. Co., Grand Rapids, Mich.

HAND PLANING AND JOINTING MACHINERY
Oliver Engineering Co., Montreal, P.Q

HAND LEATHERS OR PADS
Graton & Knight Mfg. Co., Montreal

HANDLES, FIBRE
Diamond State Fibre Co., Bridgeport, Pa.

HANGERS
Brown & Sharpe Mfg. Co., Providence, R.I
Canadian Link-Belt Co., Ltd., Toronto, Ont.

HANGERS, SHAFT
Algoma Steel Corp., Sault Ste. Marie.
Chapman Double Ball Bearing Co., Toronto.
Baird Machine Co., Bridgeport, Conn.
Can. S K F Co., Toronto, Ont.
Gardner & Son, Robt., Montreal.
Jones & Glassco, Montreal.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

HARDNESS TESTING INSTRUMENTS
Shore Instrument & Mfg. Co., New York.

HEAD, AUXILIARY
Hoefer Mfg. Co., Freeport, Ill.

HEATING AND VENTILATING ENGINEERS
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

HEAT GAUGES, HARDENING AND ANNEALING
Shore Instrument & Mfg. Co., New York

HIGH SPEED STEEL
See Steel.

HINGE MACHINERY
Baird Machine Co., Bridgeport, Conn.

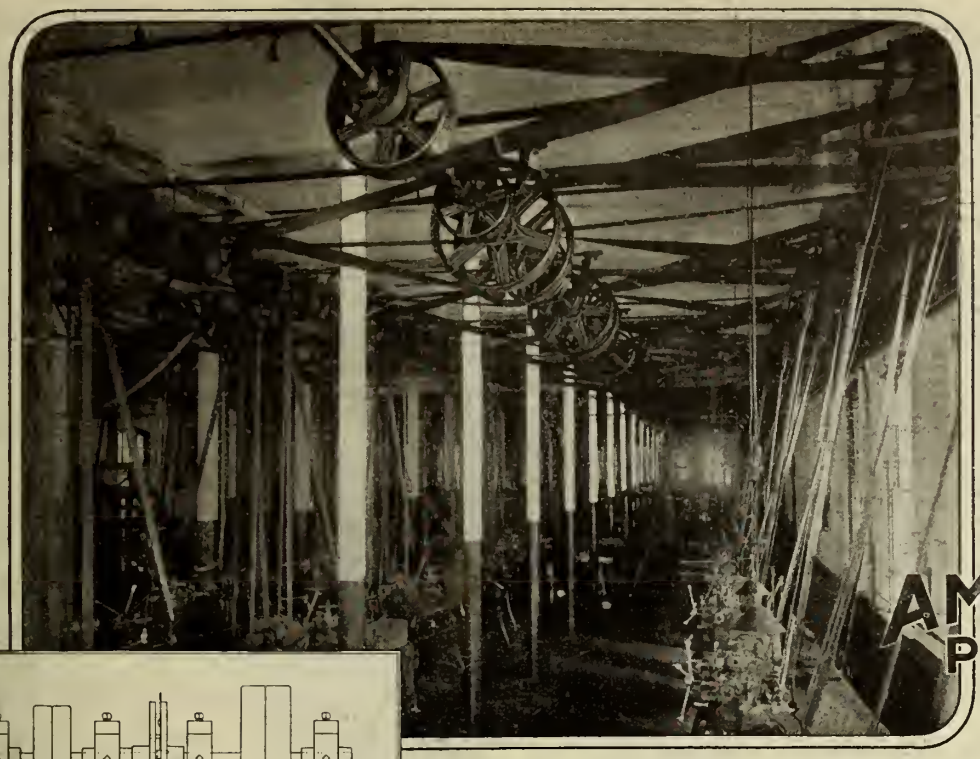
HINGES
Butterfield & Co., Inc., Rock Island, Que.
London Bolt & Hinge Wks., London, Ont.

HOBS
Greenfield Tap & Die Co., Greenfield, Mass
Pratt & Whitney Co., Dundas, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Wells Bros. of Canada Galt, Ont.

HOBBING MACHINES
Herbert, Ltd., Alfred, Toronto, Ont.

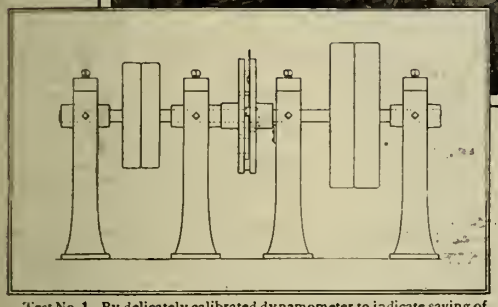
HOISTS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Holden Co., Ltd., Montreal, Que
Morris Crane & Hoist Co., Herbert.
Niagara Falls, Ont.

HOISTS, CHAIN AND PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto
Ford Chain Block & Mfg., Philadelphia.
Independent Pneumatic Tool Co., Chicago
Lyman Tube & Supply Co., Montreal, Que
Morris Crane & Hoist Co., Herbert.
Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Wright Mfg. Co., Lisbon, Ohio.
Williams Mchy Co, Ltd., A. R., Montreal

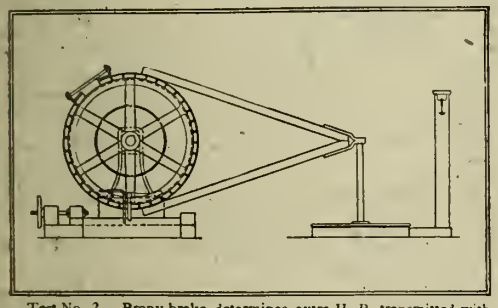


Write for free book, "Getting Maximum Pulley Efficiency"

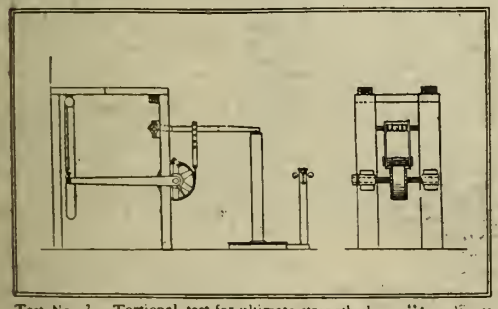
AMERICAN STEEL SPLIT PULLEYS



Test No. 1. By delicately calibrated dynamometer to indicate saving of H. P. by "American" Pulleys because of less air displacement in revolving. The edge-on arms of "Americans" cut the air instead of fanning it.



Test No. 2. Prony brake determines extra H. P. transmitted with strong but light "American" Pulley and reduced belt slip at various loads.



Test No. 3. Tortional test for ukimate strength shows "American" Pulleys resisting until strain is safely beyond normal conditions.

Where These Tests Could be Made Only One Type of Pulley Would be Used

NOTHING has awakened power users to the efficiency-increasing possibilities of pulleys so much as the exhaustive research work of The American Pulley Company.

The three devices illustrated here are typical methods by which power users could really judge with confidence the efficiency of various kinds of pulleys.

Data sheets showing results of completed tests are available to any executive or engineer.

We wish that every power user were equipped to make these and all of our other tests in his own plant. They would have a tremendous influence in helping him reduce his operating costs.

Even the data sheets describing our own research work will give you a new basis for pulley buying. Will you tell us where we might send them to you?

For name and address of nearest dealer, see Donnelley's Red Book, on file at all leading libraries, national banks and hotels.

The American Pulley Company
Philadelphia, Pa.

The AMERICAN PULLEY

"A wheel with a broad rim transmitting power from or imparting power to machinery, or changing the direction of motion by means of a flat belt."

If interested tear out this page and place with letters to be answered.

HOISTS, ELEC., STATIONARY, MONO RAIL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Oliver Engineering Co., Montreal.
Volta Mfg. Co., Welland, Ont.

HOISTS, ELECTRICAL
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
Electric Steels & Metals Ltd., Welland.
Kennedy & Sons, Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

HOLDERS, ADJUSTABLE LENGTH
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

HOLDERS, ELECTRIC
Electric Steels & Metals, Ltd., Welland

HOOKS, BELT LACING
Clipper Belt Lacer Co., Grand Rapids.

HOPPERS
MacKinnon Steel Co., Ltd., Sherbrooke.
Dominion Bridge Co., Montreal, Que.
William Hamilton Co., Peterboro, Ont.
Toronto Iron Works, Ltd., Toronto, Ont.

HOSE, FIRE PROTECTION
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal

HOSE, PNEUMATIC
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Independent Pneumatic Tool Co., Chicago.
Quaker City Rubber Co., Philadelphia, Pa.
Wells Bros. Co. of Canada, Galt, Ont.

HOSE, ALL KINDS
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HOSE, SAND BLAST
Goodyear Tire & Rubber Co. of Can., Ltd. Toronto
Quaker City Rubber Co., Philadelphia, Pa.

HOSE, STEAM, SUCTION AND WATER
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HUMIDIFIERS
Sturtevant Co., B. F., Galt, Ont.

HYDRAULIC ACCUMULATORS
Dom. Steel Products Co., Ltd., Brantford.

HYDRAULIC MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford.
Eastern Production Co., Detroit, Mich.
Garlock-Walker Machinery Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Victoria Foundry Co., Ottawa.

HYDRAULIC TURBINES
Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

HYDROMETERS, HYGROMETERS, HYGRODIKS
Taylor Instrument Co., Rochester, N.Y.

INDICATORS, SPEED
Allenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

INDEX CENTRES
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Petrie, Ltd., H. W., Toronto.

INDICATING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

INDUSTRIAL SITES
City of St. Johns, Quebec.

INGOTS, FORGING AND ROLLING
Electric Steel & Metals Co., Welland.

INSULATING COMPOUNDS
Robertson Co., Ltd., H. H., Sarnia, Ont.

IRON ORE
Hanna & Co., M. A. Cleveland, O.

IRON, WROUGHT, ROLLED, PIG
Swedish Steel & Impt. Co., Ltd., Montreal

JACKS
Allenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Can. Engineering Co.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H W., Toronto.

JACKS, PIT AND TRACK
Canadian Fairbanks-Morse Co., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Northern Crane Works, Walkerville.

JAWS, FACE PLATE
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Skinner Chuck Co., New Britain, Conn.

JIGS, TOOLS, ETC.
Ackworthie Ltd., J., Birmingham, Eng.
Brown Engineering Corp., Toronto.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Gisholt Machine Co., Madison, Wis.
Globe Engineering Co., Ltd., Hamilton.
Jones & Lamson, Springfield, Vt.

JOURNAL WEDGES
Canada Foundries & Forgings, Welland.
Dominion Foundries & Steel Ltd., Hamilton, Ont.

KEY SEATERS
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, M.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Machy. Co., A. R., Toronto.

KEYS, MACHINE
Williams & Co., J. H., Brooklyn, N.Y.

KILNS
Can. Blower & Forge Co., Kitchener, Ont.
General Combustion Co., Ltd., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

KNIVES, MACHINE
Atkins & Co., E. C., Hamilton, Ont.

LABORATORIES, INSPECTION AND TESTING (see Chemists)

LADLES, FOUNDRY
Northern Crane Works, Walkerville.

LACING MACHINES
Clipper Belt Lacer Co., Grand Rapids, M.

LAG SCREW GIMLET POINTERS
National Machy. Co., Tiffin, Ohio.

LATH
Robertson. Ltd., H. H., Sarnia, Ont.

LATHES, CHUCKING
Acme Machine Tool Co., Cincinnati, Ohio.
Petrie, Ltd., H. W., Toronto.

LATHE CHUCKS (See Chucks)

LATHE DOGS AND ATTACHMENTS
Armstrong Bros. Tool Co., Chicago.
Bardon Machine Co., Torrington, Conn.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Herbert, Ltd., Alfred, Toronto, Ont.

LATHES, AXLE
Betts Mach. Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, BORING
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.

LATHES, PRECISION, BENCH
J. G. Blount & Co., Everett, Mass.
Canadian Fairbanks-Morse Co., Montreal.
Geo. F. Foss Machy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Seneca Falls Mfg Co., Seneca Falls, N.Y.
Strelinger Co., C. A., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, BRASS
Ackworthie Ltd., J., Birmingham, Eng.
Acme Machine Tool Co., Cincinnati, Ohio.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, ENGINE
Acme Machine Tool Co., Cincinnati, O.
John Bertram & Sons, Co., Dundas.
Canada Machy. Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal.
G. F. Foss, Mchy. & S'ply Co., Montreal
Garlock-Walker Machinery Co. Toronto.
Garvin Machine Co., New York.
Gisholt Machine Co. Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
Lehman Mach. Co., St. Louis, Mo.
R. McDougall Co., Galt.
Niles-Bement-Pond Co., New York.
Perfect Machine Co., Galt, Ont.
Standard Equipment & Tool Wks. Montreal, P.Q.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Shiver Tool Co., Shiver Ohio.
Strelinger Co., C. A., Windsor, Ont.
Walcott Lathe Co., Jackson, Mich.
A. R. Williams Machy. Co., Toronto
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, FOOT POWER
Seneca Falls Mfg. Co., Seneca Falls, N.Y

LATHES, HORIZONTAL
Intern'l. Mchy. Supplies Ltd., Montreal.

LATHES, JOURNAL TRUEING
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, PATTERNMAKERS'
J. G. Blount Co., Everett, Mass.
Can. Machinery Corp., Galt.
G. F. Foss Mchy. & S'ply Co., Montreal
Garlock-Walker Machy. Co., Toronto Ont

LATHES, POLISHING
Ackworthie Ltd., J., Birmingham, Eng.
Greenfield Tap & Die Corp., Greenfield
Wells Bros. of Canada, Galt, Ont.

LATHES, SCREW CUTTING
Bertram & Sons Co., John, Dundas, Ont.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & Sply Co., G. F., Montreal
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Lehman Machine Co., St. Louis, Mo.
Niles-Bement-Pond Co, New York.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Strelinger Co., C. A., Windsor, Ont.
Williams Machy. Co., A. R., Toronto.

LATHES, SPINNING
Bliss Co., E. W., Brooklyn, N.Y.

LATHES, TOOL ROOM
Canada Machinery Corporation, Galt, Ont.
Lehman Machine Co., St. Louis, Mo.
Seneca Falls Mfg. Co., Seneca Falls, N.Y
Strelinger, Chas. A. Co., Windsor, Ont.

LATHES, QUICK CHANGE
Lehman Machine Co., St. Louis, Mo.

LATHE SAWS
Atkins & Co., E. C., Hamilton, Ont.

LATHES, TURRET
Acme Machine Tool Co., Cincinnati, Ohio
Herbert Ltd., Alfred, Toronto, Ont.

LEAD, PIG AND BAR
British Smelting & Refining Co., Ltd., Montreal, Que.
Hoyt Metal Co., Toronto, Ont.

LEAD BURNING OUTFITS
Turner Brass Works, Sycamore, Ill.

LEATHER STRAPPING
Graton & Knight Mfg. Co., Worcester, M

LENSES FOR GOGGLES
Standard Optical Co., Geneva, N.Y.

LEVELS
Hughes, Owens Co., Ltd., Montreal, Que.

LIDS, SCREW TOP AND HINGE
Can. Winkley Co., Ltd., Windsor, Ont.

LINK BELTING
See Belting, Chain.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LOCKERS, STEEL WARDROBE AND STEEL MATERIAL
Canada Wire & Iron Gds. Co., Hamilton
Dennis Wire & Iron Works, London, Ont

LUBRICANTS
Cataract Refining & Mfg. Co., Toronto
Swan & Finch, Inc., New York.

LUBRICANTS, CUTTING AND GRINDING, DRAWING, STAMPING
Oakley Chemical Co., New York, N.Y.

LUBRICATING, OIL FILTERING AND CIRCULATING SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.

LUBRICATORS
Trabern Pump Co., Rockford, Ill.

LUMBERMEN'S TOOLS
Thos. Pink Co., Ltd., Pembroke, Ont.

MACHINE COUNTER WEIGHTS
Katie Foundry, Galt, Ont.

MACHINE TOOLS
Barber Mach. Co., F. F., Toronto, Ont

MACHINERY DEALERS
Archibald & Co., Chas. P., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co. Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Machy. Co., A. R., Toronto.

MACHINERY GUARDS (See Guards)

MACHINERY SUPPLIES
Crescent Machine Co., Ltd., Montreal.
Globe Engineering Wks., Hamilton, Ont

MACHINERY, SPECIAL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Que.
McClean Machine & Tool Co., Ltd., Hamilton, Ont.

MACHINISTS' TOOLS
Atkins & Co., E. C., Hamilton, Ont.
Brown & Sharpe Mfg. Co. Providence, R.I.
Starrett Co., L. S., Athol, Mass.

MAGNETIC BRAKES FOR ELECTRIC MOTORS
Volta Mfg. Co., Welland, Ont.

MANDRELS
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont

MARKING MACHINERY
Brown, Boggs Co., Hamilton, Ont.
Foss Mchy & S'ply Co. G. F., Montreal
Perrin, Wm. R., Toronto.
Petrie, Ltd., H. W., Toronto.

MATS, RUBBER MATTING
Quaker City Rubber Co., Philadelphia, Pa
International Mchy. Sply., Ltd., Montreal

MEASURING MACHINES
Pratt & Whitney Co., Dundas, Ont.

MEASURES, REGISTERING
Bowser Co., Ltd., S. F., Toronto, Ont.

MEASURING TAPES AND RULES
Chesterman & Co., Jas., Sheffield, Eng.

MERCHANTS, IRON AND STEEL
Samuel Osborne (Can.), Ltd., Montreal

METALLURGISTS
See Chemists.

METAL CLEANERS
Oakley Chemical Co., New York, N.Y.

METAL CUTTING MACHINES
Atkins & Co., E. C., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.

METAL SAWS
See Saws.

METAL SAWS, POWER
E. C. Atkins & Co., Inc., Indianapolis.
Hoefer Mfg. Co., Freeport, Ill.
Lyman Tube & Supply Co., Montreal, Que.

METALS
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.
Canada Metal Co., Toronto, Ont.
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
Hoyt Metal Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.

METAL, STAMPINGS, SMALL
Can. Winkley Co., Ltd., Windsor, Ont.

METERS, OIL, GASOLINE, KEROSENE, ETC.
Bowser Co., Ltd., S. F., Toronto, Ont.
General Combustion Co., Ltd., Montreal, Que.

MICROMETERS
Taylor, J. A. M., 318 Stair Bldg., Toronto.
Petrie, Ltd., H. W., Toronto.

MILLS, BRACE AND TUBE
Elec. Steel & Metals, Welland, Ont.

MILL SPECIALTIES
Atkins & Co., E. C., Hamilton, Ont.

MILLS, SAND
Frost Mfg. Co., Chicago, Ill.

MILL MACHINERY
Alexander Fleck, Ltd., Ottawa.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

MILLING ARBORS
Ackworthie Ltd., J., Birmingham, Eng.
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Strelinger, Chas. A. Co., Windsor, Ont.

MILLING ATTACHMENTS
Ackworthie Ltd., J., Birmingham, Eng.
Bertram & Sons Co., John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Hendey Mach. Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.

MILLING MACHINES, AUTOMATIC
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Betts Machine Co., Rochester, N.Y.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.

MILLING CUTTERS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Milling Machine Co., Cleveland.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Herbert, Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

MILLING MACHINES HAND
Bristol Machine Tool Co., Bristol, Conn.

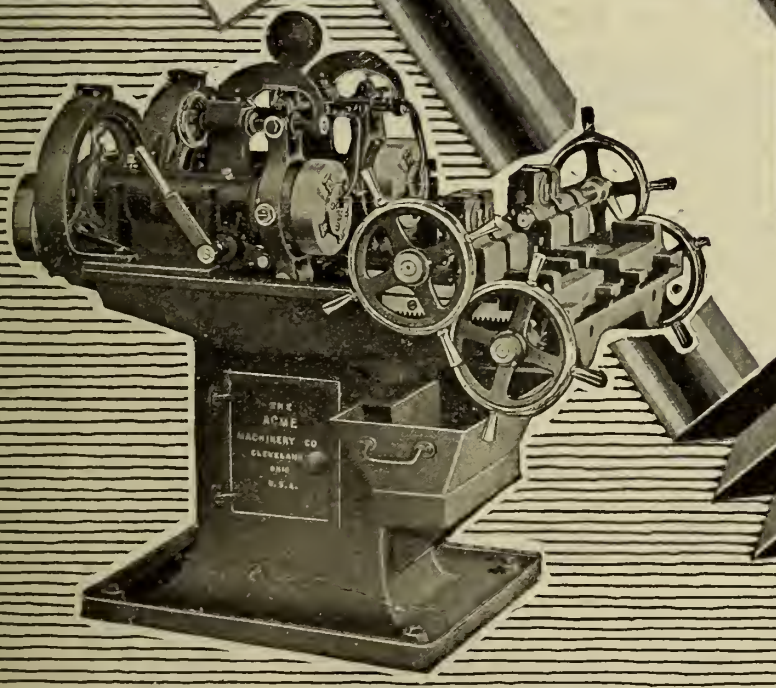
MILLING MACHINES, THREAD
Gisholt Machine Co., Madison, Wis.
United States Mach. Tool Co., Cincinnati.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.
Strelinger, Chas. A. Co., Windsor, Ont.

MILLING MACHINES, HORIZONTAL AND VERTICAL
Bristol Machine Tool Co., Bristol, Conn.
Brown & Sharpe Mfg. Co., Providence.
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Cochrane-Bly Co., Rochester, N.Y., U.S.A
Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co. Toronto Ont.
Herbert, Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd. H. W., Toronto.
Rockford Milling Mach. Co., Rockford, Ill
Strelinger, Chas. A. Co., Windsor, Ont.
United States Mach. Tool Co., Cincinnati.
Williams Machy. Co., A. R., Toronto.

MILLING MACHINES, PLAIN, BENCH AND UNIVERSAL
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cleveland Milling Machine Co., Cleveland.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.

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Garvin Machine Co., New York.
Herbert, Ltd., Alfred, Toronto, Ont.
National Machy. Co., Tiffin, Ohio.
Gosley & Edlund, Inc., Cortland, N.Y.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.
Strelinger, Chas. A. Co., Windsor, Ont.

MILLING MACHINES, PROFILE

Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

MILLING TOOLS

Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MINE CARS

Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dominion Bridge Co., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Pratt & Whitney Co., Dundas, Ont.

MINING MACHINERY

Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.
Holden Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MIXERS, SAND

Frost Mfg. Co., Chicago, Ill.

MORTISING CHAINS

Renold of Canada Ltd., Montreal.

MORTISING MACHINES

Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.

MOTORS, ELECTRIC

Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Toronto.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Sturtevant Co., B. F., Galt, Ont.
Volta Mfg. Co., Welland, Ont.
Williams Mach'y Co., A. R., Toronto.

MOTOR SPRINGS

The Dunbar Brothers Co., Bristol, Conn.

MOTORCYCLE FRAME AND FORK

The Dunbar Brothers Co., Bristol, Conn.

MOTORS, PNEUMATIC

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto.
Holden Co., Ltd., Montreal, Que.

MOULDS, RUBBER

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

MULTIPLE INDEX CENTRES

Garvin Machine Co., New York.
Graton & Knight Mfg. Co., Worcester, M.

MULTI-DRILLING, MULTI-BORING, MULTI-TAPPING MACHINERY,

Nat. Automatic Tool Co., Richmond, Ind.

MUNICIPALITIES

City of St. John, Quebec.

NAIL SETS

Morrow Screw & Nut Co., J., Ingersoll, Ont

NAME PLATES, BRONZE, ETCHED AND STAMPED

Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS

Can. Driver-Harris Co., Ltd., Walkerville.

NICKEL

Pilot Steel & Tool Co., Montreal, Que.

NICKEL STEEL

See Steel.

NICKEL SILVER—SHEETS, ROLLS, PLATES and RODS

Brown's Copper and Brass Rolling Mills, New Toronto.

NIPPLE THREADING MACHINES

Landis Machine Co., Waynesboro Pa
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

NITROGEN

Carter Welding Co., Toronto, Ont.

NUTS, STEEL, CASTELLATED AND COLD PRESSED

Galt Machine Screw Co., Ltd., Galt, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Williams & Co., J. H., Brooklyn, N.Y.

NUTS, SEMI-FINISH AND FINISHED

Galt Machine Screw Co., Galt, Ont.
National-Acme Co., Cleveland, Ohio.
Wilkinson & Kompass, Hamilton.

NUT LOCKS

Edw. W. Robinson Co., Ltd., Montreal.

NUT BURRING AND NUT MACHINES (HOT)

National Machy. Co., Tiffin, Ohio.

NUT FACING AND BOLT SHAVING MACHINES

Garvin Machine Co., New York.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Victor Tool Co., Waynesboro, Pa.

NUT TAPPERS

Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

OILERS

All-Way Oiler Mfg. Co., Toronto, Ont.

OIL SEPARATORS

Can. Fairbanks-Morse Co., Montreal.

OIL STONES

Aikenhead Hardware Co., Toronto, Ont.
Carborundum Co., Niagara Falls N.Y
Norton Co. of Canada, Ltd., Hamilton, Ont.
Norton Co., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

OIL STONE GRINDERS

Oliver Machy. Co., Grand Rapids, Mich.

OIL STORAGE SYSTEMS

Bowser Co., Ltd., S. F., Toronto, Ont.

OPENING DIE HEADS

Greenfield Tap & Die Corp, Greenfield.
Wells Bros. of Canada, Galt, Ont.

ORE HANDLING EQUIPMENT

Brown Hoisting Machinery Co., Cleveland, Ohio.
Canadian Link-Belt Co., Ltd., Toronto, Ont.

OSCILLATING VALVE GRINDERS (PNEUMATIC)

Cleveland Pneumatic Tool Co. of Canada, Toronto.

OVENS FOR BAKING, BLUING, DRYING, ENAMELING, JAPANNING AND LACQUERING

Brantford Oven & Rack Co., Brantford.

OVEN TRUCKS, STEEL

Brantford Oven & Rack Co., Brantford
MacKinnon Steel Co., Sherbooke, Que.

OVENS FOR DRYING, TEMPER AND OXYGEN, ELECTROLYTIC CELLS UNDER TRUCKS

Brantford Oven & Rack Co., Brantford

OXY-ACETYLENE WELDING AND CUTTING AND OUTFITS

Carter Welding Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
L'Air Liquide Society, Toronto, Ont.
Prest-o-Lite Co., Inc. Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.

OXYGEN

Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.
Nat. Electro Products Ltd., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.

OXYGEN PLANTS (ELECTROLYTIC)

Davis-Bournonville Co., Toronto, Ont.

PACKINGS, ASBESTOS

Cleveland Wire Spring Co., Cleveland.

PACKING, ROD AND SHEET

Dunlop Tire & Rubber Goods Co., Ltd. Toronto.
Goodyear Tire & Rubber Co., Can., Ltd., Toronto
Gutta Percha & Rubber, Ltd., Toronto.
International Mach. Spls., Ltd., Montreal
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co., Philadelphia, Pa

PANS, WET AND DRY

Frost Mfg. Co., Chicago, Ill.

PAPER MILL CONVEYORS AND DRIVES

Bertrams, Ltd., Edinburgh, Scotland.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Gutta Percha & Rubber, Ltd., Toronto.
MacKinnon Steel Co., Sherbrooke, Que

PARTITIONS, WIRE

See Guards

PAPER MILL MACHINERY

Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Garlock-Walker Machinery Co., Toronto
Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

PATTERN SHOP EQUIPMENT

Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Oliver Machy. Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.

PATTERN MAKERS' LATHES

See Lathes.

PATENT SOLICITORS

Fetherstonhaugh & Co., Ottawa.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.

PECK CARRIERS FOR POWER PLANTS

Can. Link-Belt Co., Toronto, Ont.

PENSTOCKS

William Hamilton Co., Peterboro, Ont.

PERFORATED METALS AND ORNAMENTAL IRON GOODS

Canada Wire & Iron Goods Co., Hamilton

PHOSPHOR TIN, COPPER AND BRONZE

British Smelting & Refining Co., Ltd., Montreal, Que.

PHOTOSTATS

Commercial Camera Co., Providence, R.I.

PIG IRON

Hanna & Co., M. A., Cleveland, O.
Steel Co. of Canada, Ltd., Hamilton, Ont.

PINS, TAPER

Morrow Screw & Nut Co., J., Ingersoll, Ont

PINS, BELT-LACING

Clipper Belt Lacer Co., Grand Rapids.

PIPE, BLACK & GALVANIZED

Crane, Ltd., Montreal, Que.

PIPE FITTINGS, MALLEABLE AND CAST IRON

International Malleable Iron Co., Guelph.

PIPE CUTTING AND THREADING MACHINES

Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
McDougall Co., R., Galt.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

PIPE, JOINT COMPOUNDS

Crane, Ltd., Montreal, Que.

PIPE RIVETED STEEL

Toronto Iron Works, Ltd., Toronto.
William Hamilton Co., Peterboro, Ont.

PIERCING

Oliver Machy. Co., Grand Rapids, Mich.

PIPE CUTTERS, ROLLING

Greenfield Tap & Die Corp., Greenfield.
Wells Bros. Co. of Canada, Galt, Ont.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

PIPE TOOLS AND DIES

Ackworthie Ltd., J., Birmingham, Eng.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE CUTTERS AND REAMERS

Greenfield Tap & Die Corp., Greenfield.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. of Canada, Galt, Ont.

PIPE STOCKS AND THREADERS

Greenfield Tap & Die Corp., Greenfield.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. of Canada, Galt, Ont.

PIPE TAPS AND VISES

Ackworthie Ltd., J., Birmingham, Eng.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE WRENCHES

Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PISTON AND PISTON RING MACHINES

National Acme Co., Windsor, Vt.

PLANER BOLTS

Atkins & Co., E. C., Hamilton, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont

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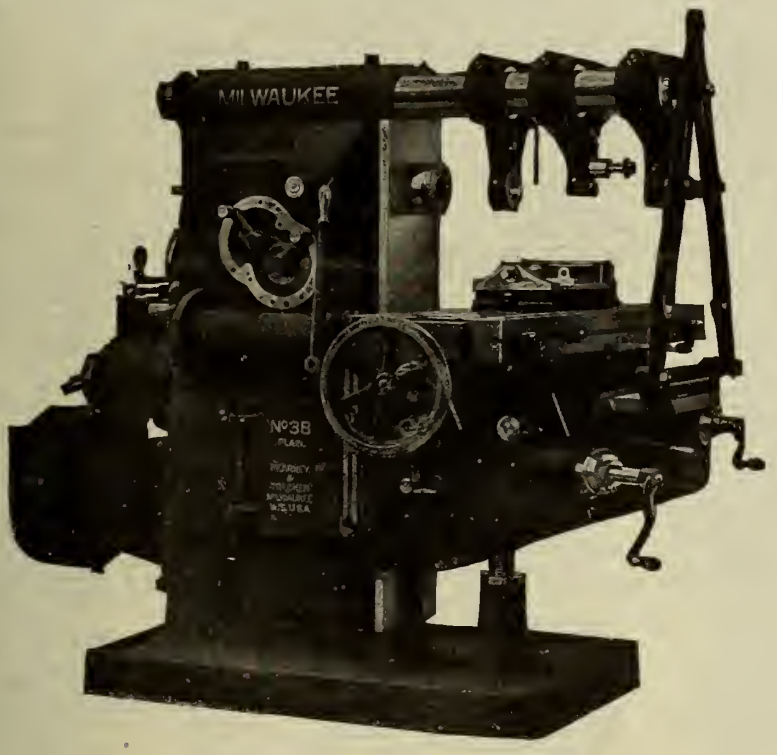
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National Acme Co., Montreal.
Rice Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.

SCREW COLLARS
Galt Machine Screw Co., Ltd., Galt, Ont.
John Morrow Screw & Nut Co., Ingersoll.

SCREW MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence, R.I.
Herbert, Ltd., Alfred, Toronto, Ont.

SCREW PLATES
Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto.
J. A. M. Taylor, Stair Bldg., Toronto.
Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton.

SCREWS, SAFETY SET
Galt Machine Screw Co., Ltd., Galt, Ont.

SCREW SLOTTERS
Butterfield & Co., Inc., Rock Island, Que.
Garvin Machine Co., New York.
National Acme Co., Cleveland, O.
Pratt & Whitney Co., Dundas, Ont.

SELF-OPENING DIES
See Dies.

SET SCREWS, SAFETY
Aikenhead Hardware Co., Toronto.
Bristol Co., Waterbury, Conn.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wilkinson & Kompass, Hamilton.

SHANKS, STRAIGHT AND TAPER
Jacobs Mfg. Co., Hartford, Conn.

SHAPERS
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt.
Cochrane-Bly Co., Rochester, N.Y., U.S.A.
Geo. F. Foss Mchy. & Sply. Co., Montreal
Robt. Gardner & Son, Montreal.
Garlock-Walker Mach'y. Co., Toronto.
Herbert, Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
Standard Equipment & Tool Wks., Montreal.
Walcott Lathe Co., Jackson, Mich.
Williams Mchy Co., A. R., Toronto, Ont.

SHAPERS, GEAR
Fellows Gear & Shaper Co., Springfield, V.

SHAFTING
Algoma Steel Corp., Sault Ste. Marie, O.
Can. Fairbanks-Morse Co., Montreal.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glassco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

SHARPENING STONES
Norton Co. of Canada, Ltd., Hamilton, Ont.
Norton Co, Worcester, Mass.
Rice, Lewis & Son, Toronto.

SHEARING MACHINES, ANGLE IRON, BAR AND GATE
John Bertram & Sons Co., Dundas.
Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

SHEARS, POWER
John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Strelinger, Chas. A. Co., Windsor, Ont.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co., A. R., Toronto, Ont.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio

SHEARS, PLATE CUTTING, SLITTING
Dom. Steel Products Co., Ltd., Brantford.

SHEARS, SPLITTING
Dom. Steel Products Co., Ltd., Brantford.

SHEARS, IRREGULAR AND CIRCLE CUTTING
D. H. Stoll Co., Inc., Buffalo, N.Y

SHEARS, SQUARING
Brown Boggs & Co., Hamilton, Ont.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING MACHINERY
Herbert, Ltd., Alfred, Toronto, Ont.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING TOOLS
Baird Machine Co., Bridgeport, Conn.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Inc., Buffalo, N.Y.
Strelinger, Chas. A. Co., Windsor, Ont.

SHEETS, CRUCIBLE, CAST
British Smelting & Refining Co., Ltd., Montreal, Que.

SHEETS, BLACK AUTO AND GALVANIZED
Peckovers, Ltd., Toronto, Ont.

SHEETS, NICKEL, RESIST. ALLOY
Can. Driver-Harris Co., Ltd., Walkerville.

SHELVING, STEEL
Dennis Wire & Iron Works, London.

SHIPYARD MACHINERY, SHOP FURNITURE
Dennis Wire & Iron Works, London.

SIDE TOOLS
Armstrong Bros. Tool Co., Chicago.
I. H. Williams & Co., Brooklyn, N.Y.

SILENT CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
Renold of Canada Ltd., Montreal.

SLEDGES
Aikenhead Hardware Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont

SLINGS, CHAINS
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

SLOTTERS
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Herbert, Ltd., Alfred, Toronto, Ont.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.

SMOKESTACKS
William Hamilton Co., Peterboro, Ont.
MacKinnon Steel Co., Sherbrooke, Que

SNIPS, TINNERS AND SHEET METAL WORKERS
Kearney & Trecker Co., Milwaukee, Wis
J. Morrow Screw & Nut Co., Ingersoll, Ont

SOCKETS
Brown & Sharpe Mfg. Co., Providence
Butterfield & Co., Inc., Rock Island, Que
Cleveland Twist Drill Co., Cleveland
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

SOIL PIPE FITTINGS, CAST IRON
Katie Foundry, Galt, Ont.

SOLDERING IRONS
Aikenhead Hardware Co., Toronto, Ont.
Brown, Boggs & Co., Hamilton, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

SOLDER
British Smelting & Refining Co., Ltd. Montreal, Que.
Aikenhead Hardware Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Hoyt Metal Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton

SPELTER
British Smelting & Refining Co., Ltd. Montreal, Que.

SPEED REDUCING GEARS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

SPRINGS, MACHINERY
Barnes Wallace Co., Bristol, Conn.
Can. Steel Foundries, Ltd., Montreal.
Cleveland Wire Spring Co., Cleveland.
Dunbar Bros. Co., Bristol, Conn.
Garlock-Walker Machinery Co., Toronto

SPECIAL MACHINERY
Baird Machine Co., Bridgeport, Conn.
Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Brown Engineering Corp., Toronto, Ont
Dom. Steel Products Co., Ltd., Brantford
Ford-Smith Machine Co., Hamilton, Ont
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
Globe Engineering Co. Ltd., Hamilton
Hamilton Co., Ltd., Wm., Peterborough
A. B. Jardine & Co., Hespeler, Ont
Katie Foundry, Galt, Ont.
Ker & Goodwin Machine Co., Ltd. Brantford, Ont.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
National-Acme Co., Cleveland, Ohio
Niagara Machine Co., Pittsburgh, Pa.
Stoll Co., D. H., Buffalo, N.Y.
Victoria Foundry Co., Ottawa, Ont.
William R. Perrin, Ltd., Toronto.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

SPECIAL TOOLS, MACHINERY
Crescent Machine Co., Ltd., Montreal, Que.
McClean Machine & Tool Co., Ltd., Hamilton, Ont.

SPOT FACERS, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

SPRING COILING AND WINDING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.

SPRING MAKING MACHINERY (AUTOMATIC)
Baird Machine Co., Bridgeport, Conn.

SPRINGS, SPIRAL, TOOL
The Dunbar Bros. Co., Bristol, Conn.

SPRINGS STEEL
Barnes Co., Wallace, Bristol, Conn.

SPROCKETS, COMPENSATING
Morse Chain Co., Ithaca, New York.

SPROCKETS, SPRING
Morse Chain Co., Ithaca, New York.

SPROCKETS, CHAIN
Can Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia
Renold of Canada Ltd., Montreal.

SPRINGS FOR TOYS AND ELECTRIC DEVICES
The Dunbar Bros. Co., Bristol, Conn.

SPROCKET WHEELS, CAST
Can. Link Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Ltd Montreal

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

SANDERS
Oliver Mach. Co., Grand Rapids, Mich

SAW BENCHES
Oliver Mach. Co., Grand Rapids, Mich

SAW GUARDS
Oliver Mach. Co., Grand Rapids, Mich

SAWING MACHINES
Herbert Ltd., Alfred, Toronto, Ont.

SAWS SWING
Oliver Mach Co., Grand Rapids, Mich.

SMALL TOOLS
Herbert Ltd., Alfred, Toronto, Ont.

STAYBOLT TOPS
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

STAIRS, IRON
Canada Wire & Iron Goods Co., Hamilton, Ont.

STAMPINGS, SHEET BRASS, COPPER, ALUMINUM AND STEEL
Dom. Forge & Stamping Co., Walkerville
Globe Engineering Co., Hamilton, Ont.

STAMPING MACHINERY
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs, & Co., Hamilton, Can
Canada Machinery Corp., Galt, Ont.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich

STEAM APPLIANCES
Darling Bros., Ltd., Montreal, Quebec.

STEAM SEPARATORS AND TRAPS
Can. Fairbanks-Morse Co., Montreal.

STEAM TURBINES
General Combustion Co., Ltd., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

STEEL BALLS
See Balls Steel.

STEEL, CRUCIBLE TOOL
Atkins & Co., Ltd., Wm. Sheffield, Eng
Illingworth Steel Co., John, New York
Marshall, Son & Bunney, Toronto

STEEL, CARBON, FERRO-TUNGSTEN
Armstrong, Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng
Firth & Sons, Thos., Montreal, Que
Latrobe Electric Steel Co., Latrobe, Pa
Lincoln Electric Co. of Canada, Ltd Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Peckovers, Ltd., Toronto, Ont.
Samuel Osborne (Can.), Ltd., Montreal
Vanadium-Alloys Steel Co., Pittsburgh

STEEL, CHROME MOLYBDENUM
United Alloy Steel Corp., Canton, Ohio.

STEEL CHROME VANADIUM
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm. Sheffield, Eng
Marshall, Son & Bunney, Toronto
United Alloy Steel Corp., Canton, Ohio.

STEEL CHROME NICKEL
Firth & Sons, Ltd., Thos., Montreal,
Lyman Tube & Supply Co., Ltd., Montreal
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng
Marshall, Son & Bunney, Toronto
United Alloy Steel Corp., Canton, Ohio.

STEEL CASTINGS
Can. Elec. Steel Casting Co., Aurora, Ont
Davidson Mfg. Co., Ltd., Montreal, Que.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Dom. Iron & Steel, Sydney, N.S.
Kennedy & Sons, Wm., Owen Sound
Electric Steel & Metals Co., Welland
Nova Scotia Steel & Coal Co., Windsor
Swedish Crucible Steel Co., Windsor

STEEL, COLD DRAWN
United Alloy Steel Corp., Canton, Ohio.

STEEL, COLD ROLLED
Atkins & Co., Ltd., Wm., Sheffield, Eng
Can. Drawn Steel Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

STEEL, ELECTRIC FURNACE
United Alloy Steel Corp., Canton, Ohio.

STEEL FJAB
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.

STEEL, NICKEL
Atkins & Co., Ltd., Wm., Sheffield, Eng
Marshall, Son & Bunney, Toronto.
United Alloy Steel Corp., Canton, Ohio.

STEEL, HIGH SPEED
Armstrong-Whitworth of Can., Montreal
Wm. Atkins & Co., Sheffield, Eng.
Can. Fairbanks-Morse Co., Montreal
Deloro Smelting & Refining Co., Ltd Toronto, Ont.
H. A. Drury Co., Ltd., Montreal.
Firth & Sons, Thos., Montreal, Que.
Illingworth Steel Co., J., New York.
Latrobe Electric Steel Co., Latrobe, Pa
Marshall, Son & Bunney, Toronto, Ont
Osborne, Samuel, Montreal, P.Q.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, OPEN HEARTH
Illingworth Steel Co., John, New York
United Alloy Steel Corp., Canton, Ohio.

STEEL PLATES
Dominion Foundries & Steel Ltd., Hamilton, Ont.

STEEL PRODUCTS AND MACHINERY
Dom. Steel Products Co., Ltd., Brantford

STEEL, ROCK DRILL
Armstrong, Whitworth of Canada, Montreal, Que.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

STEEL, SPECIAL ANALYSIS
United Alloy Steel Corp., Canton, Ohio.

STEEL, SPRING AND REINFORCING
Peckovers, Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie
MacKinnon Steel Co., Sherbrooke, Que.
Peckovers, Ltd., Toronto, Ont.

STEEL, TOOL
Armstrong, Whitworth of Can., Montreal
Atkins & Co., Wm., Sheffield, Eng.
Can. Fairbanks-Morse Co., Montreal
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Co., H. A., Montreal, Que.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Firth & Sons, Thos., Montreal, Que
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont.
Latrobe Electric Steel Co., Latrobe, Pa.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL TUBING
Tube Co. of Canada, Ltd., Toronto, Ont.

STEEL, VANADIUM
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Armstrong, Whitworth of Can., Montreal
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Drury, H. A., Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Vanadium-Alloys Steel Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

"STELLITE"
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.

STOCK RACKS FOR BARS, PIPING, ETC.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

STOCKS AND DIES
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.

STOCKS, PIPE
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros., Co., of Canada, Galt, Ont.

STONES, COMMUTATORS
Lyman Tube & Supply Co., Ltd., Montreal

STRAIGHTENING MACHINERY
Baird Machinery Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland.

STRAND
Dom. Steel Products Co., Ltd., Brantford.
Page Steel & Wire Co., Adrian, Mich.

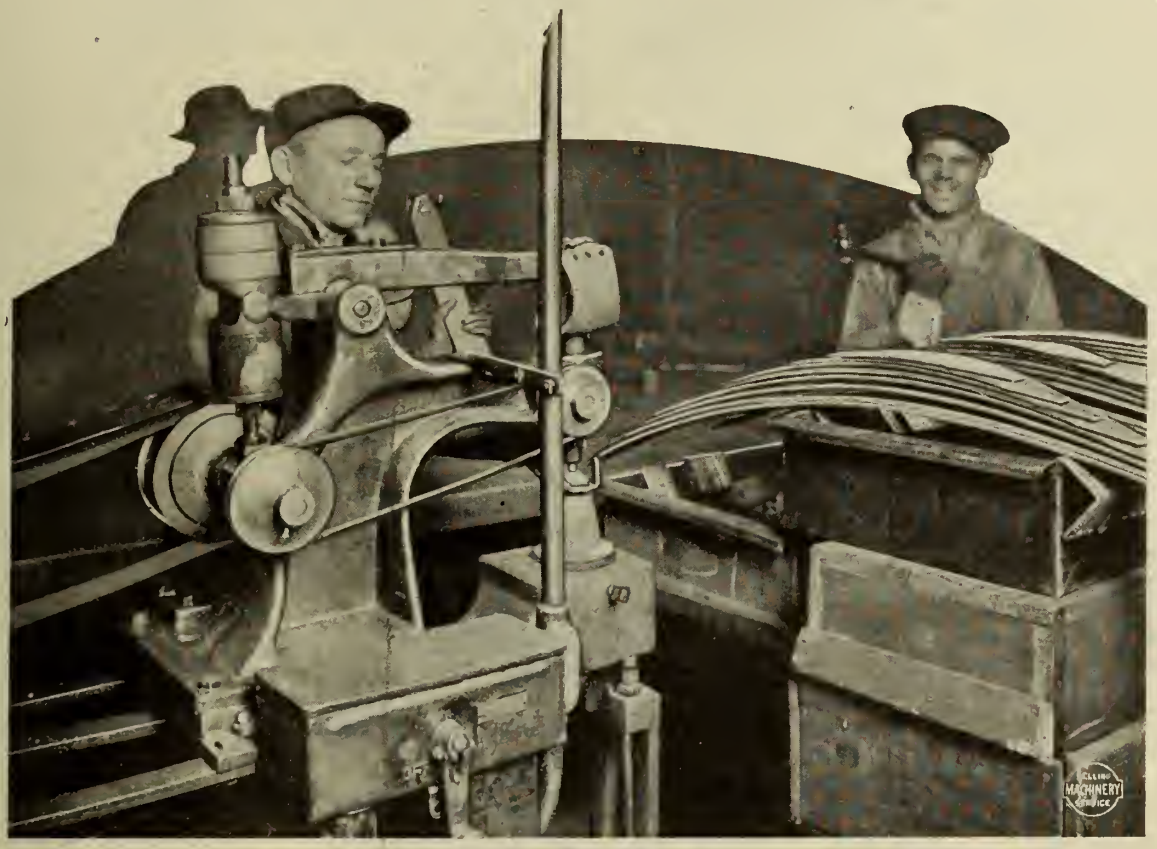
SURFACE PLATES
Brown & Sharpe Mfg. Co., Providence, R.I

STRUCTURAL STEEL WORKS
William Hamilton Co., Peterboro, Ont.

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High Speed Hammers
on Auto Springs



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You are invited to submit your riveting problems to us. Send sample with loose rivets or sketch showing dimensions, size and location of rivets, we will do the rest.

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Economy Drawing Table Co., Adrian, Mich.

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Cleveland Pneumatic Tool Co., Toronto.

TANKS, AIR, EXPANSION
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, GASOLINE, KEROSENE AND OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville.
MacKinnon Steel Co., Sherbrooke, Que.
Marshall, Son & Bunney, Toronto.

TANKS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, PNEUMATIC AND CLOSET
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

TANKS, STEEL, WATER PRESSURE
Bowser Co., Ltd., S. F., Toronto, Ont.
Dominion Bridge Co., Montreal, Quebec.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd, Toronto.

TANK WAGONS
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto.

TANKS, WELDED
Can. John Wood Mfg. Co., Ltd., Toronto
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

TANKS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
William Hamilton Co., Peterboro, Ont.

TAPER PINS
Galt Machine Screw Co., Ltd., Galt, Ont.

TAPES, MEASURING
James Chesterman & Co., Ltd., Sheffield, Eng.
Rice Lewis & Son, Toronto, Ont.

TAPPING MACHINES AND ATTACHMENTS
Bertram, John & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll Rand Co., Ltd., Sherbrooke, Que.
Garvin Machine Co., New York.
The Geometric Tool Co., New Haven.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Murchy Machine & Tool Co., Detroit.
Niles-Bement-Pond Co., New York.
National-Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
L. S. Starrett Co., Athol, Mass.
Strelinger, Chas A. Co., Windsor, Ont.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

TAPS, ADJUSTABLE
Butterfield & Co., Rock Island, Que.
Geometric Tool Co., New Haven.
Ingersoll Mach. Co., Ingersoll, Ont.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Pilot Steel & Tool Co., Montreal, Que.
Victor Tool Co., Waynesboro, Pa.

TAPS, GUN, HAND, BOILER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE RELIEVED
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE SCREW
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, PIPE
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
Wells Bros. of Can., Galt, Ont.

TAPS, STAYBOLT, TAPPER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

TAPS, DIES AND WRENCHES
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Sply. Co., G. F., Montreal.
Geometric Tool Co., New Haven.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Morse Twist Drill & Mchy. Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Strelinger, Chas. A. Co., Windsor, Ont.
Taylor, J. A. M., 313 Stair Bldg., Toronto.
Wells Bros. of Canada, Galt, Ont.

TAP EXTRACTORS
Walton Co., The, Hartford, Conn.

THERMOMETERS, INDUSTRIAL ENGRAVED TEMPERATURE AND PRESSURE
Taylor Instrument Co., Rochester, N.Y.

THERMOMETERS, RECORDING AND INDEX
Bristol Co., Waterbury, Conn., U.S.A.
Taylor Instrument Co., Rochester, N.Y.

TESTING INSTRUMENTS, METALLURGICAL
Shore Instrument & Mfg. Co., New York.

TENOVERS
Oliver Machy. Co., Grand Rapids, Mich

TESTING LABORATORIES
Toronto Testing Laboratory, Toronto.

THREAD-CUTTING MACHINES
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Mach. Co., Ltd., Toronto
Geometric Tool Co., New Haven.
Jardine & Co., Ltd., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.
National Machy. Co., Tiffin, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt., Ont.

THREADING TOOLS
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Greenfield.
Landis Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

THREADING MACHINES FOR BOLTS, NUTS AND PIPES
Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt., Ont.

THUMB SCREWS AND NUTS
See Screws.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

TIN—PIG AND BAR
British Smelting & Refining Co., Ltd., Montreal, Que.
Hoyt Metal Co., Toronto, Ont.

TINSMITHS' TOOLS
Brown, Boggs & Co., Hamilton, Can.
Petrie, Ltd., H. W., Toronto.

TIRE BENDERS
Jardine & Co., Ltd., A. B., Hespeler.

TIRE SETTING MACHINES, HYDRAULIC
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Perrin, Ltd., William R., Toronto.

TOOL CASES
Rice Lewis & Son, Toronto, Ont.

TOOL HOLDERS
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago.
Cleveland Twist Drill Co., Cleveland.
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL MAKERS
Samuel Osborne (Can.), Ltd., Montreal.

TOOL POSTS, LATHE
Armstrong Bros. Tool Co., Chicago.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL ROOM EQUIPMENT
Herbert Ltd., Alfred, Toronto, Ont.

TOOL ROOM PARTITIONS
Canada Wire & Iron Goods Co., Hamilton.

TOOLS, BLACKSMITHS'
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son Toronto, Ont.

TOOLS, ADJUSTABLE BORING
Petrie, Ltd., H. W., Toronto.

TOOLS, ELECTRIC
Ford-Smith Machine Co., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Chicago.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Machy. Co., A. R., Toronto.
U. S. Electrical Tool Co., Cincinnati, O.

TOOLS, FORMING
Davidson Tool Mfg. Co., New York, N.Y.
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.

TOOLS, LUMBERING
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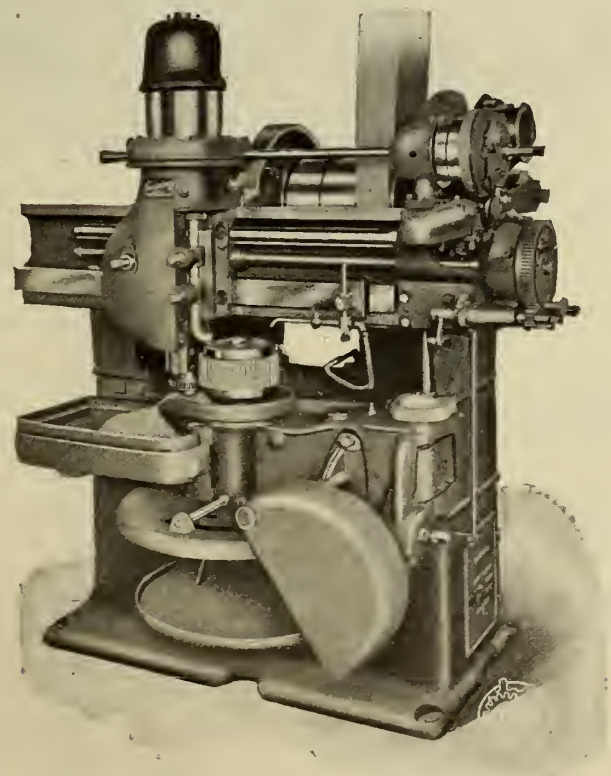
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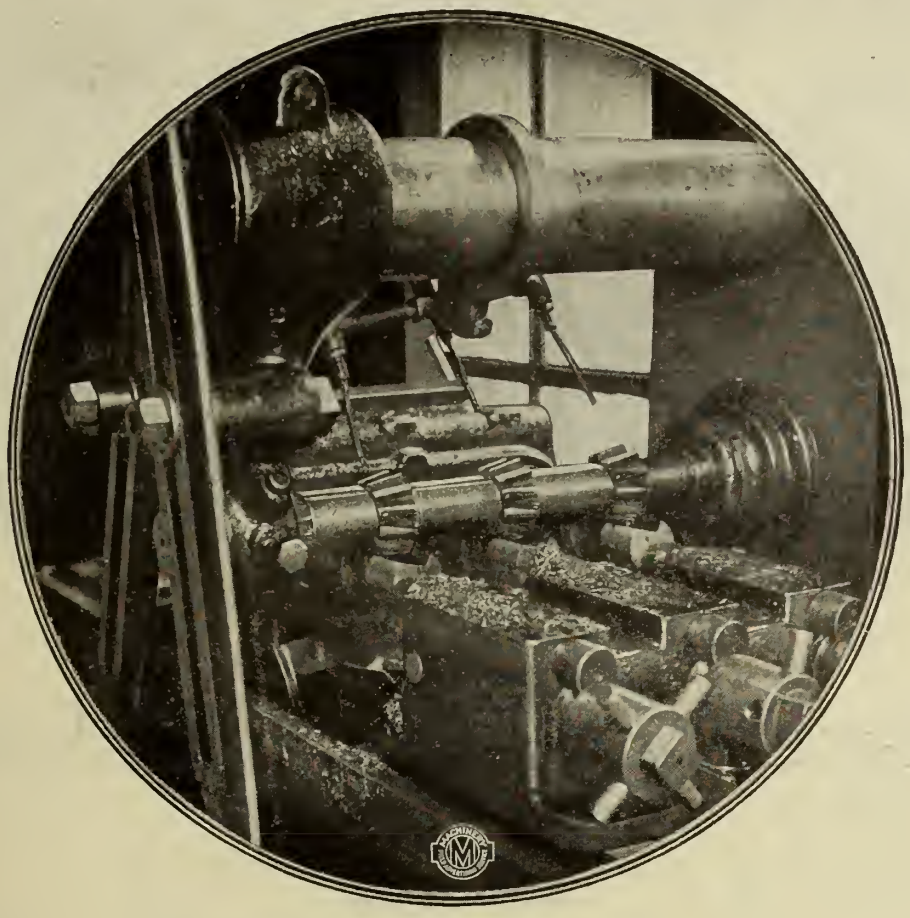
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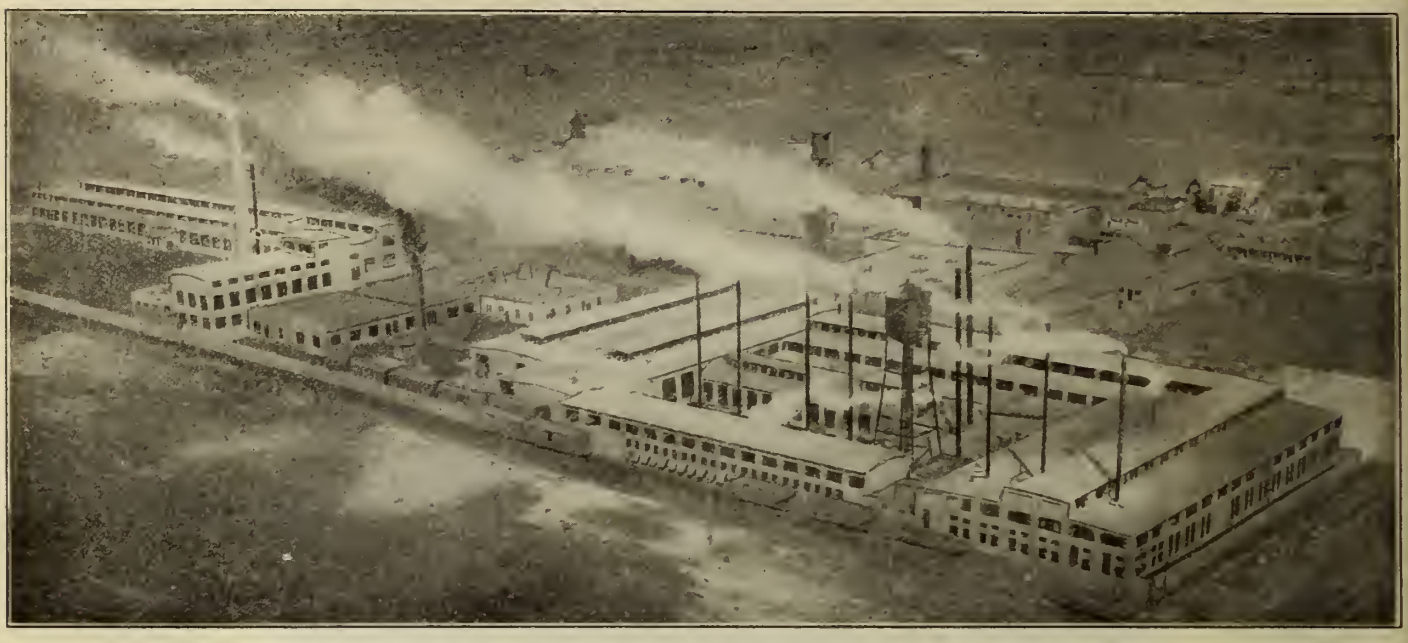
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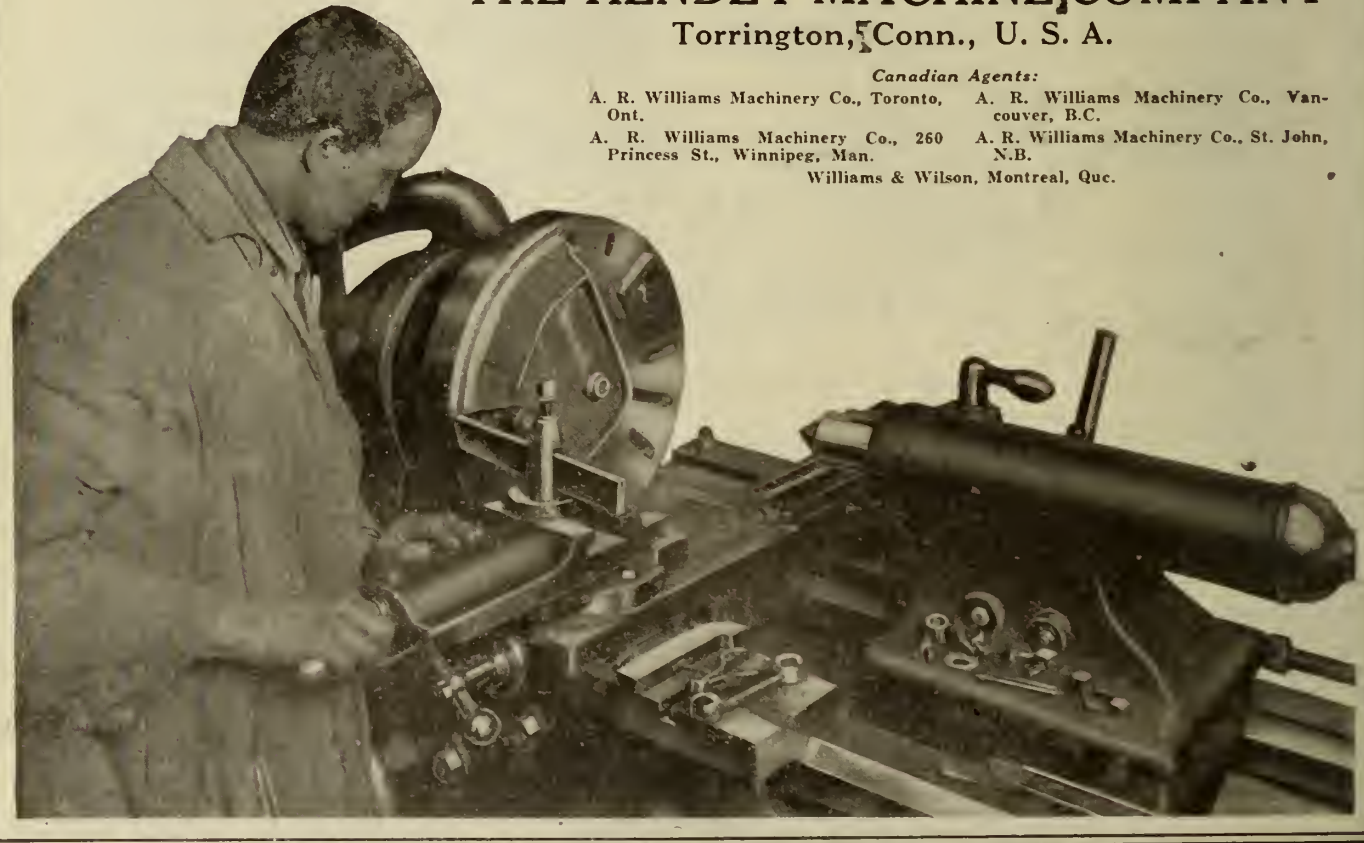
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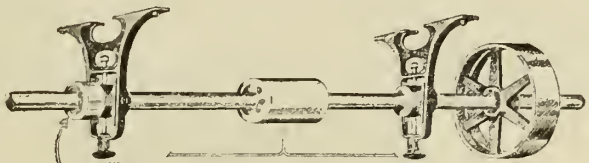
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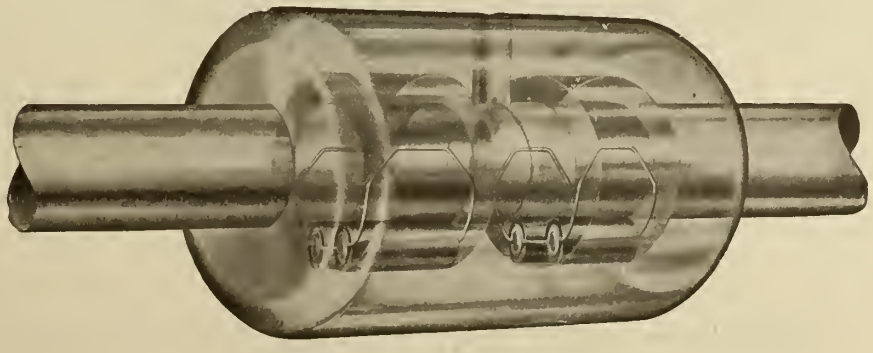
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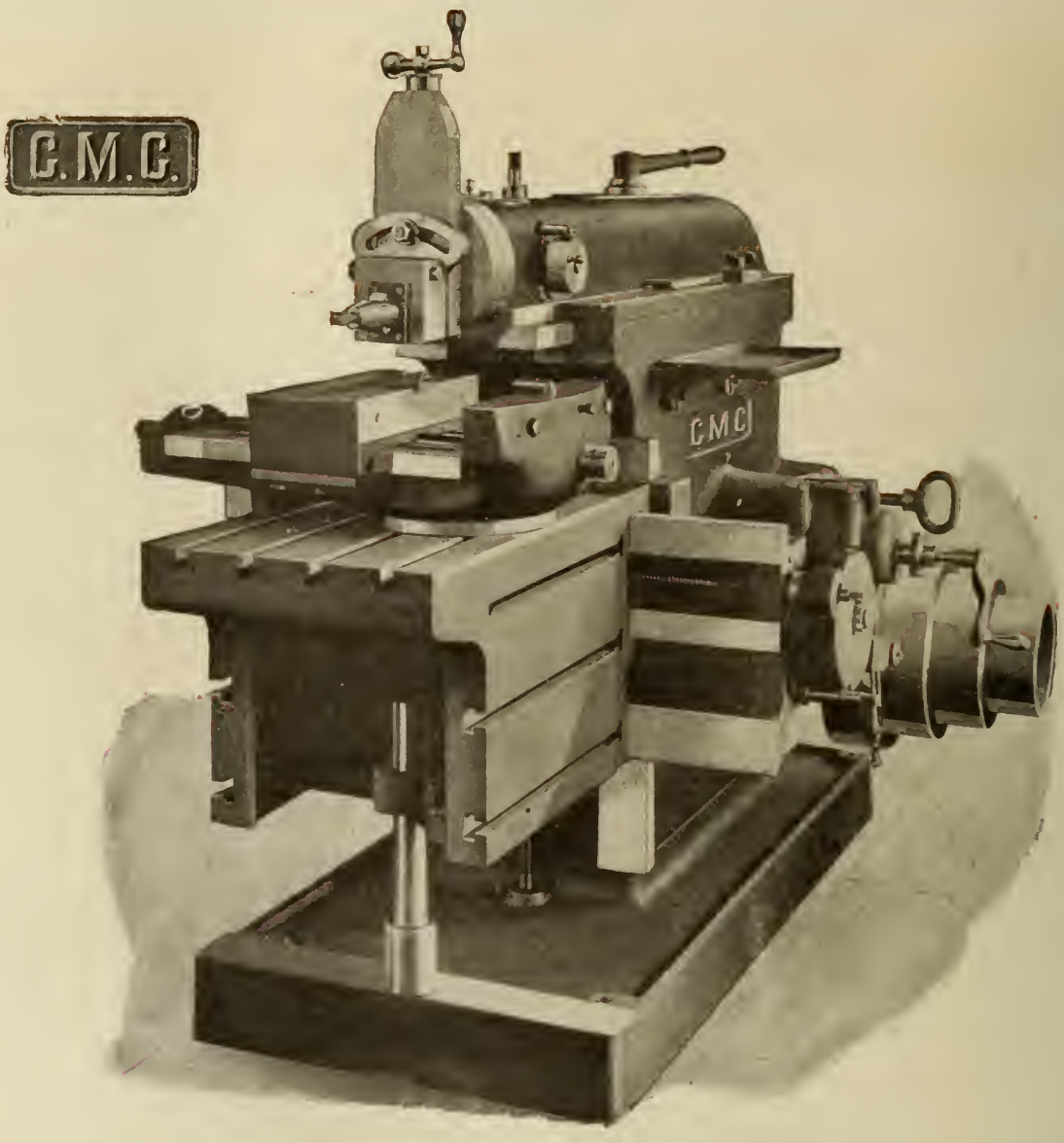
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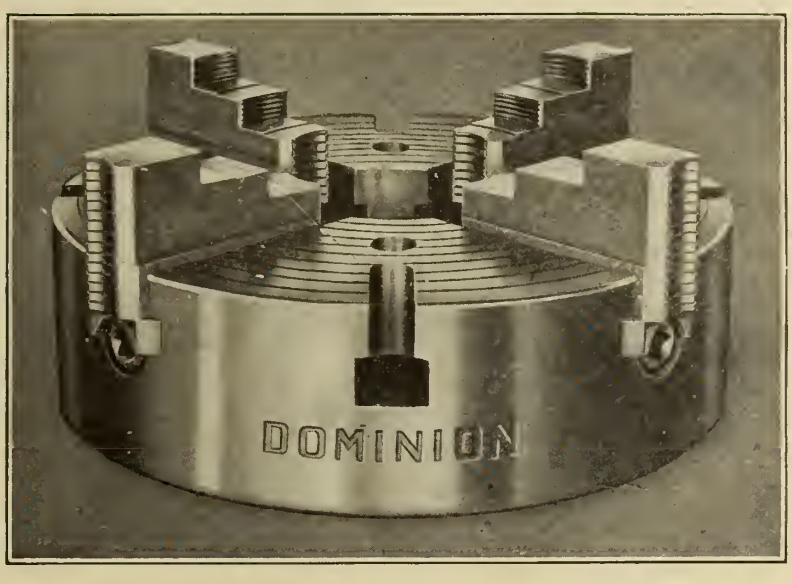
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CANADIAN MACHINERY AND MANUFACTURING NEWS

Vol. XXIV., No. 16 Published by the MacLean Publishing Company, Limited, Toronto October 14, 1920 $4.00 a Year Subscription Price

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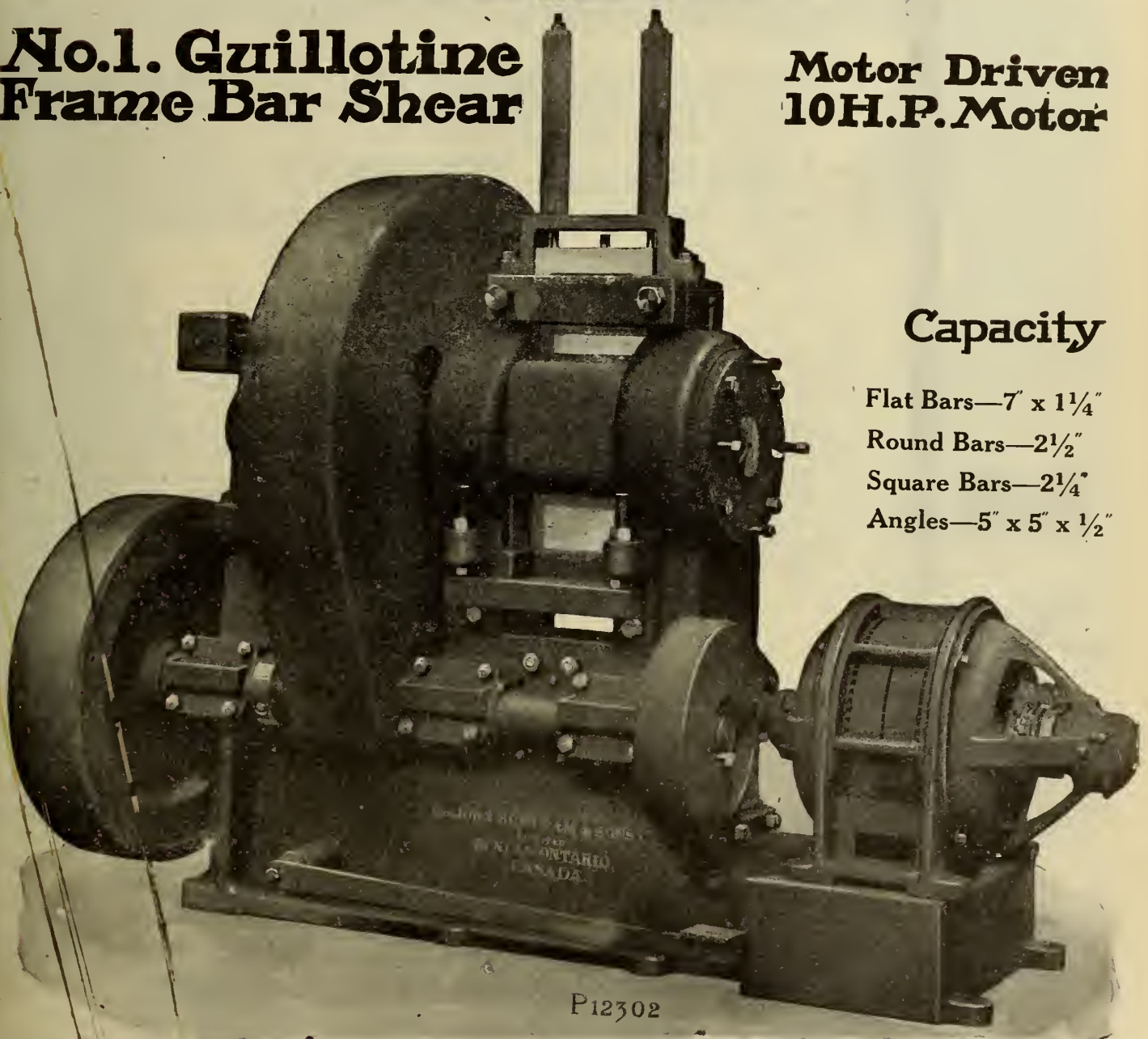


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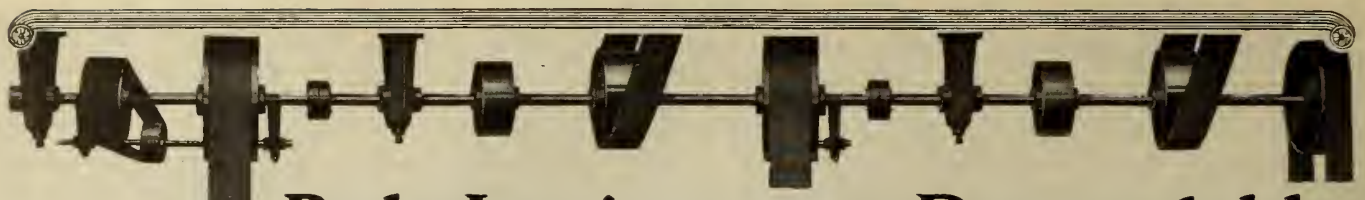
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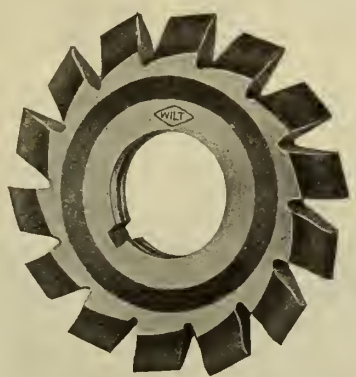
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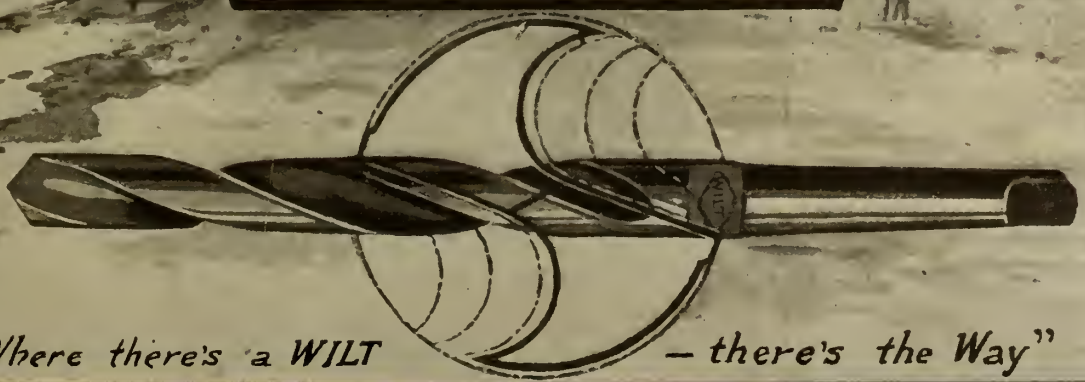


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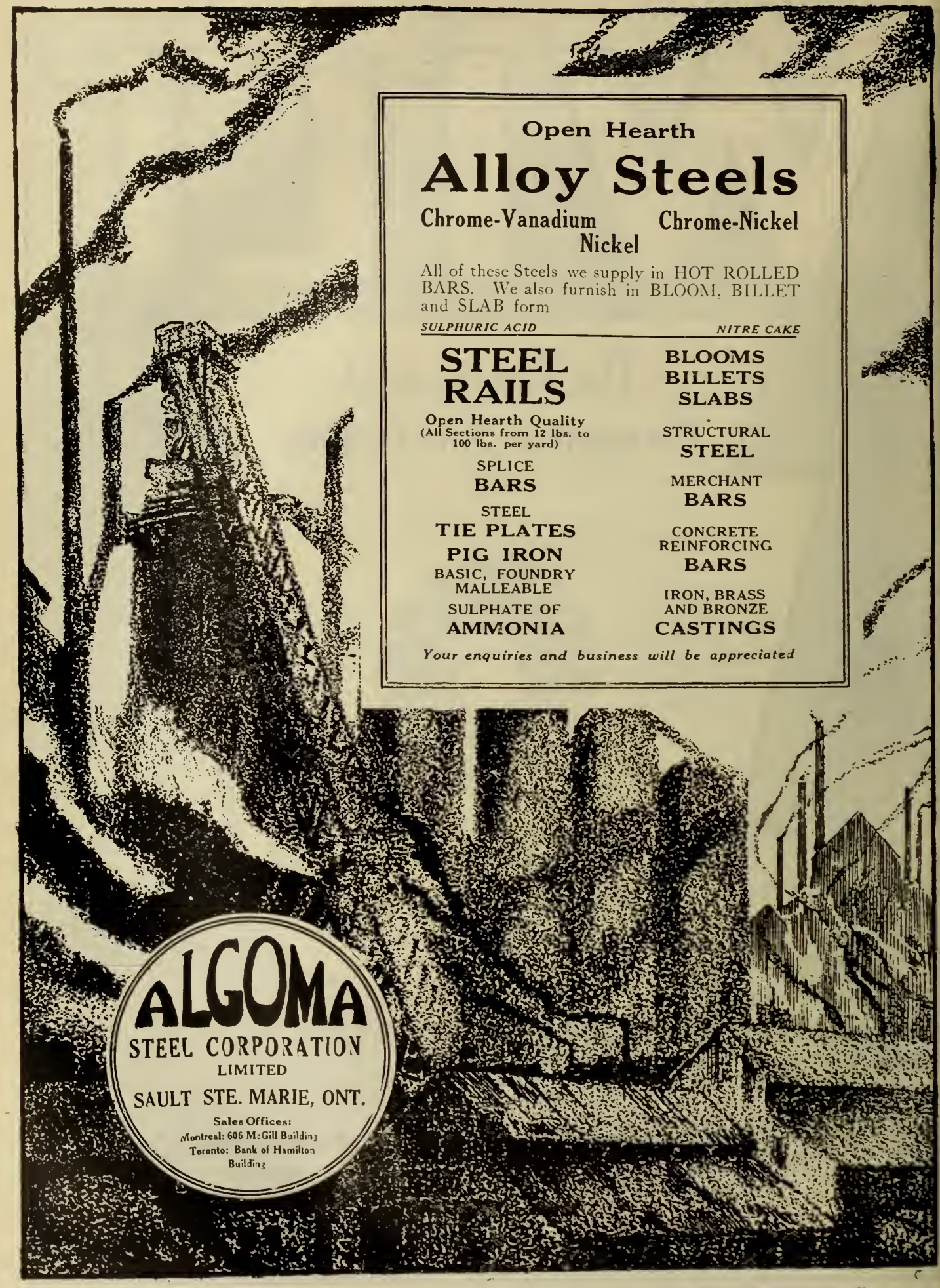
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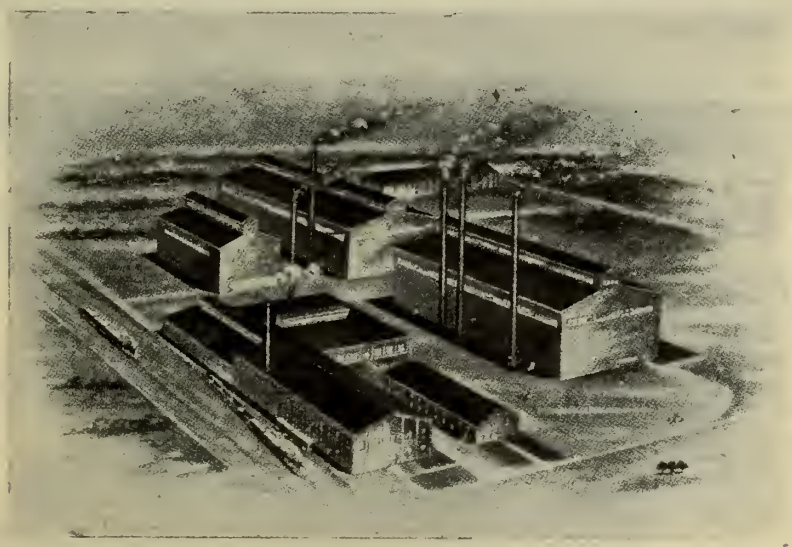
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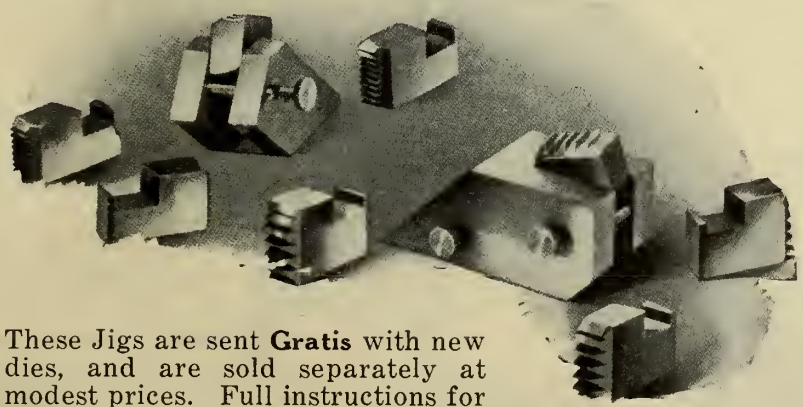
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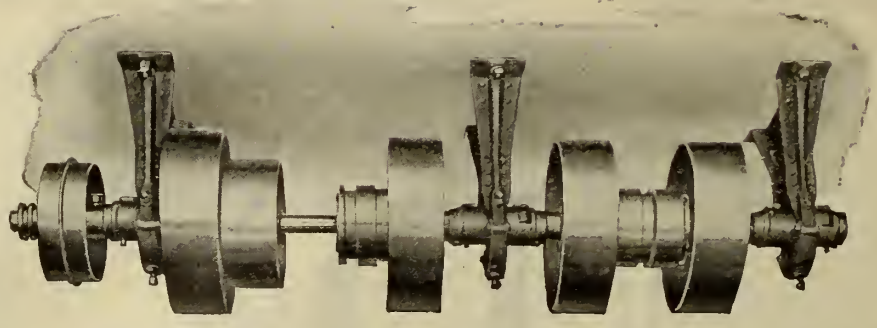
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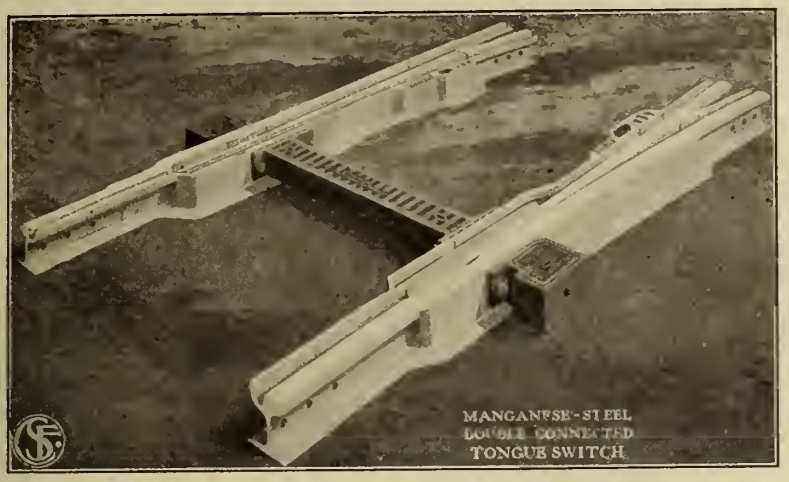
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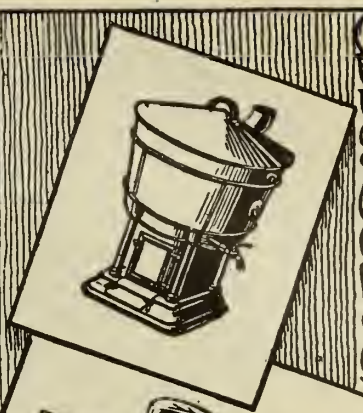
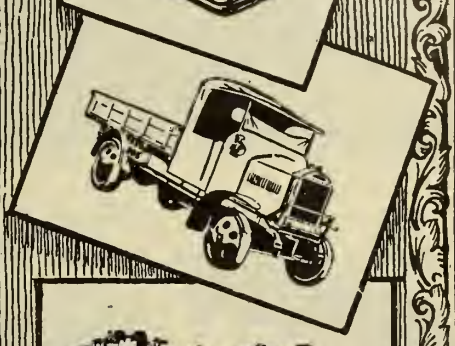
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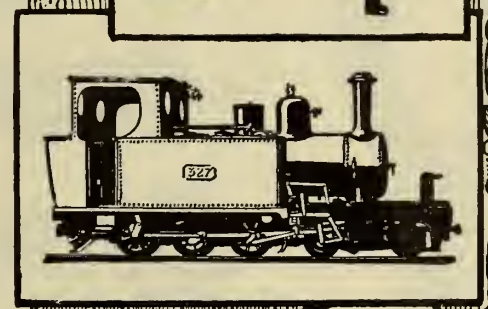
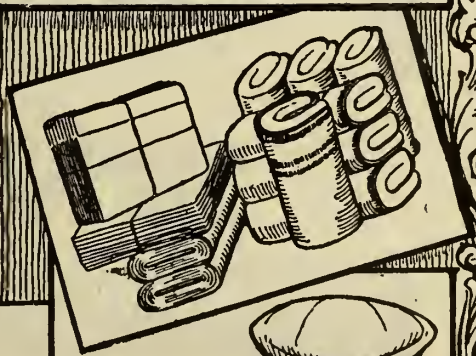
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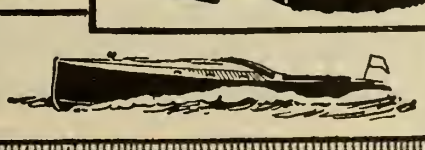
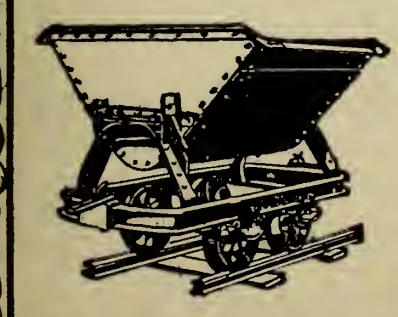
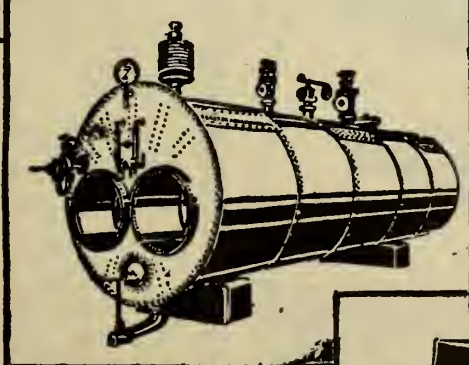
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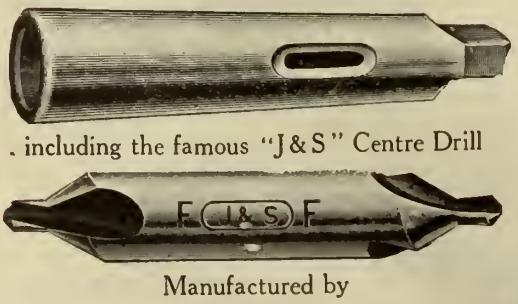
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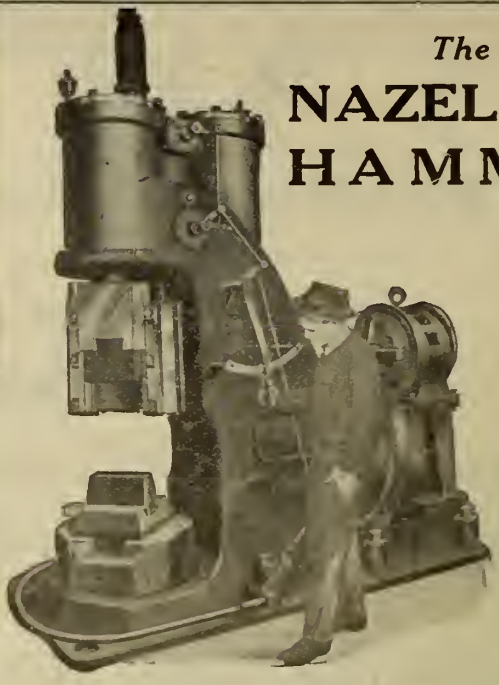


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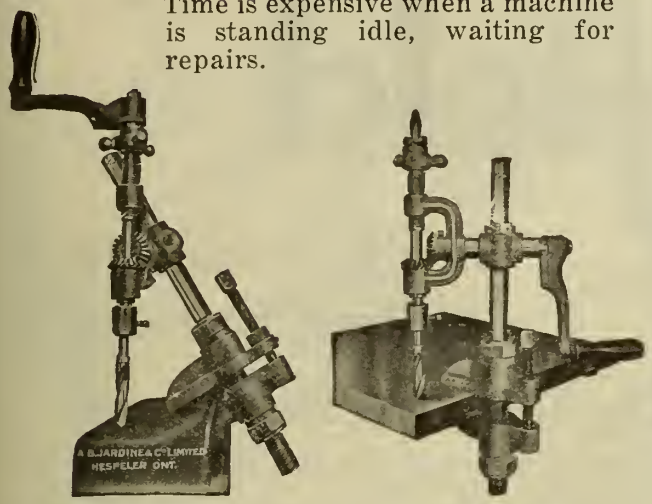
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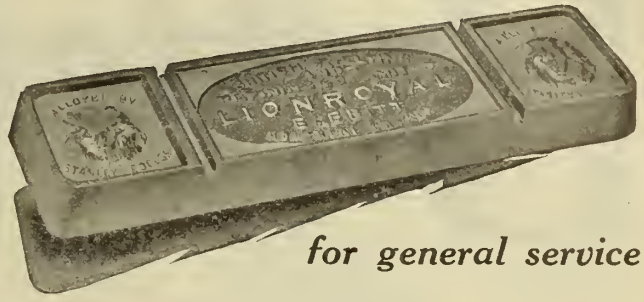
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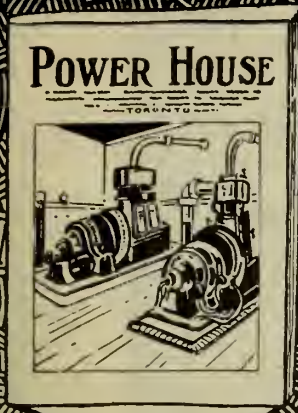
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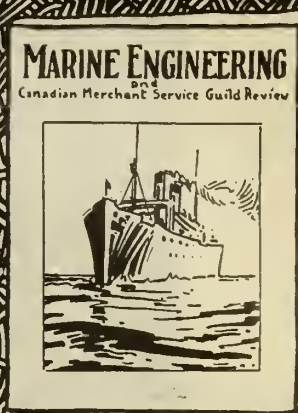


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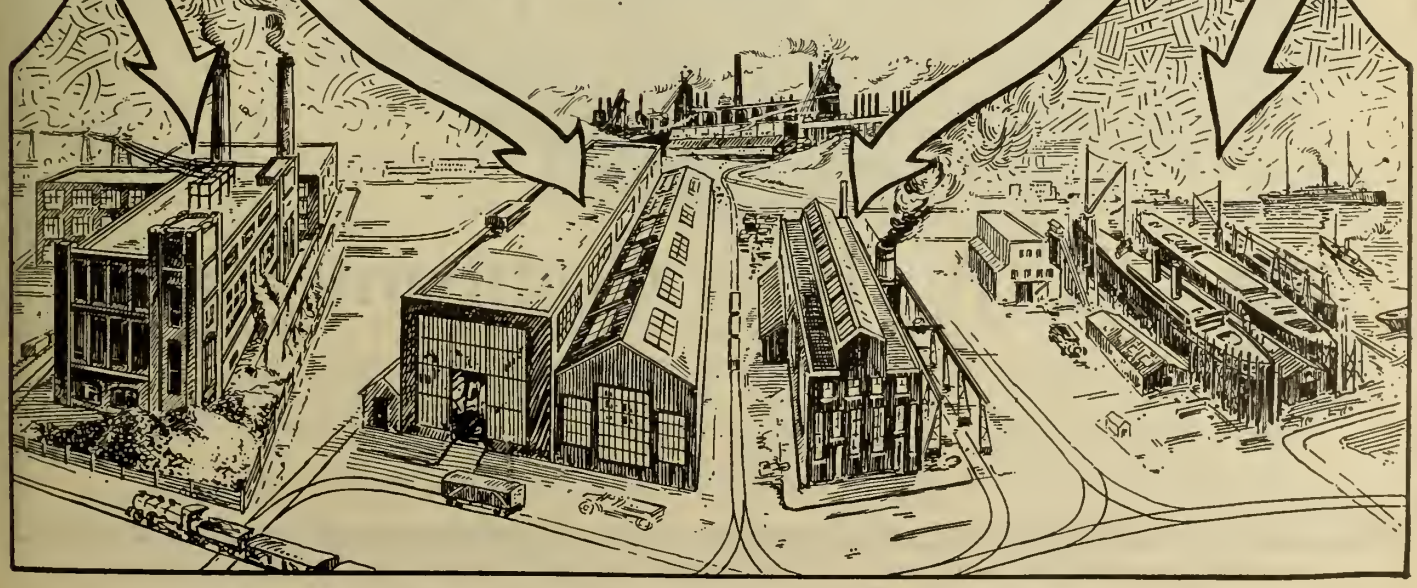
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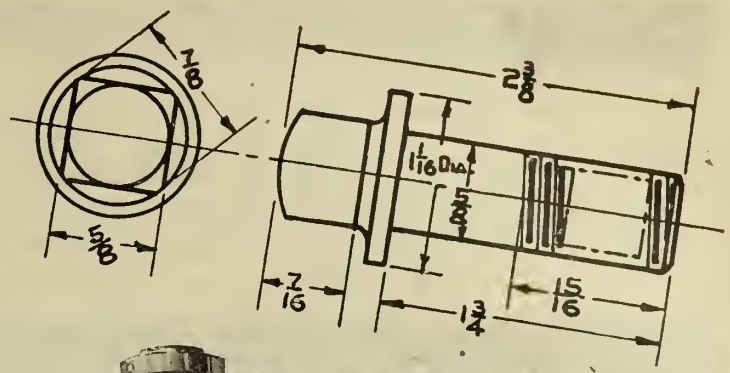
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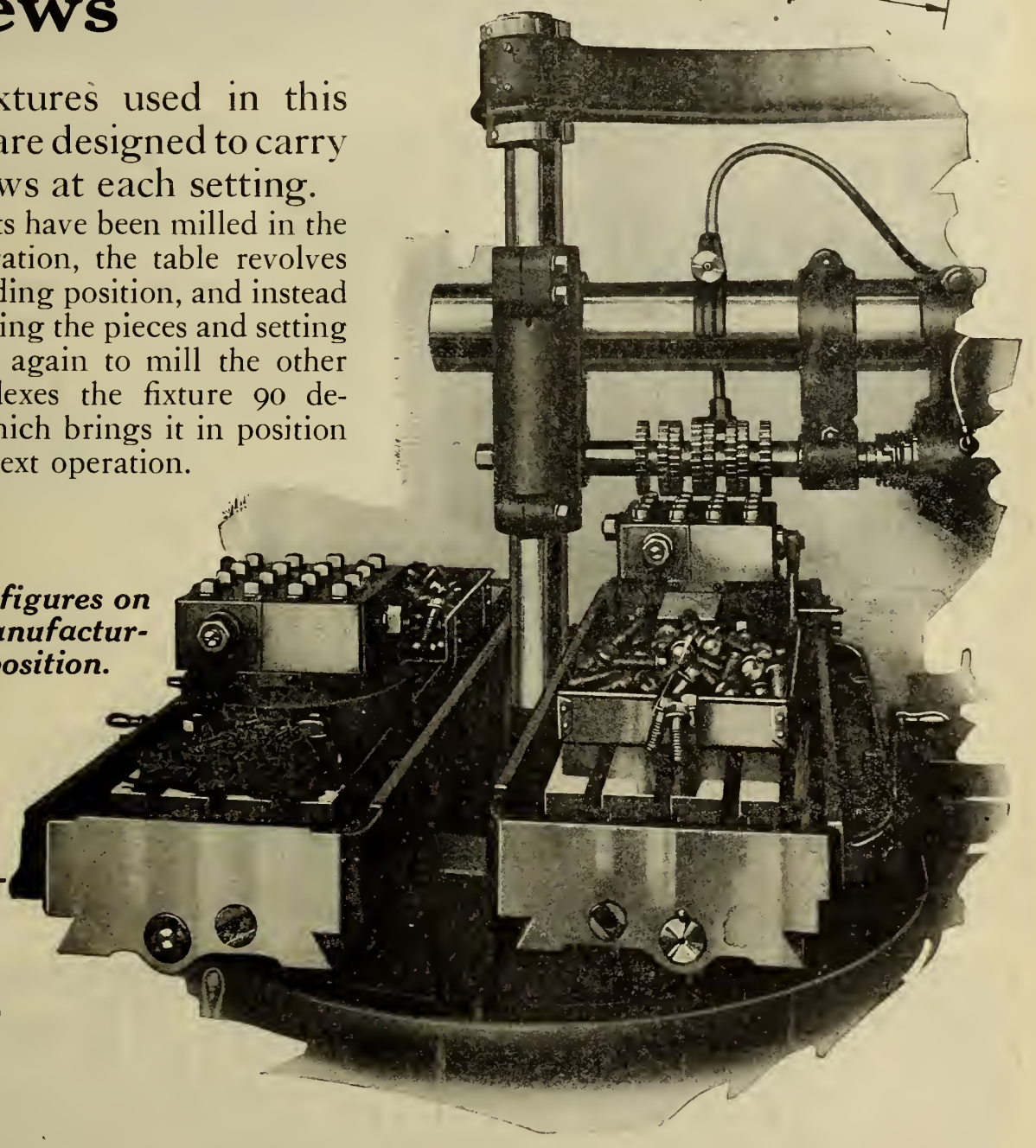
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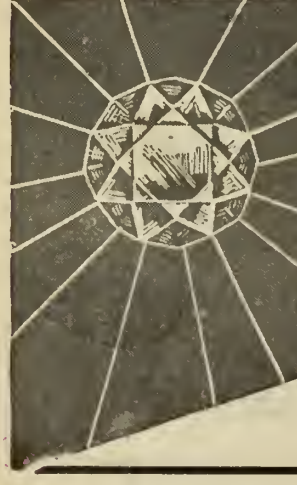
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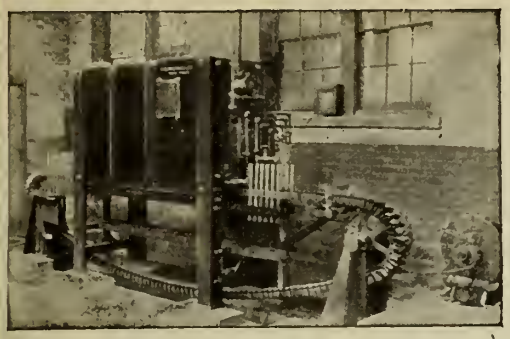
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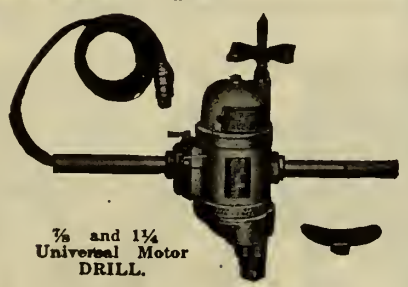
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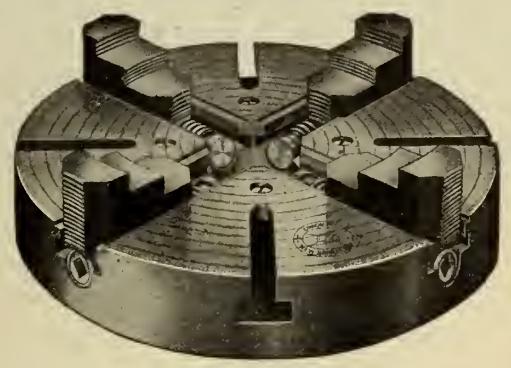
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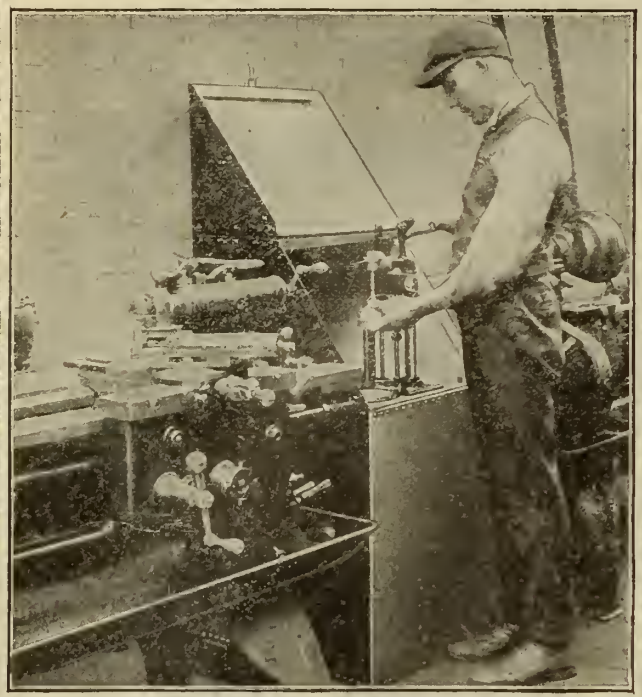
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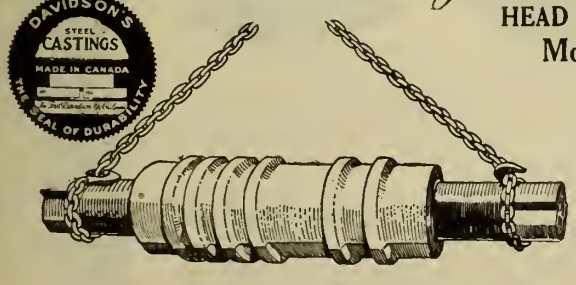
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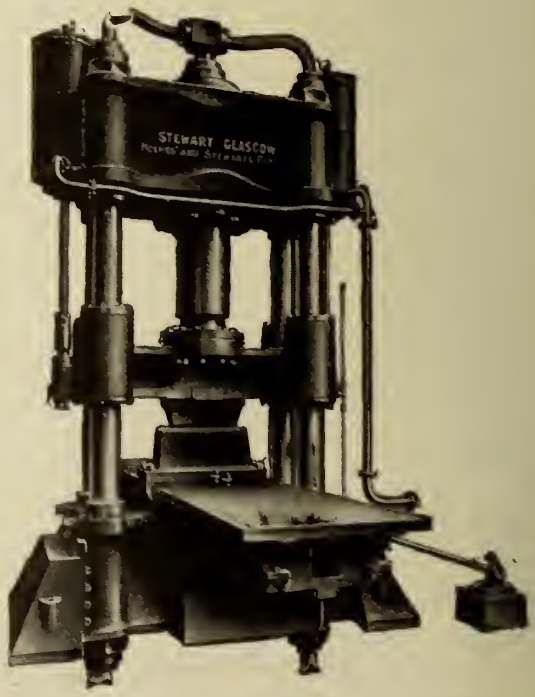
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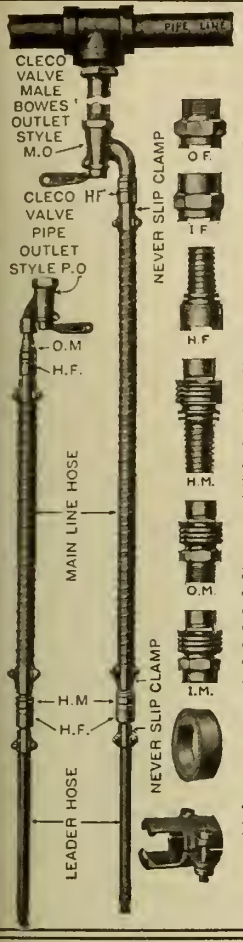
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Hot Saws.
Ingot Stripping Cranes.
Steam Hammers.
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Patent High Speed Steam Hydraulic Forging Presses, 150 to 12,000 tons.
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High Pressure Hydraulic Pumps.
Accumulators.



1200-Ton Steam Hydraulic Forging Press



Cleco Pressure-Seated Air Valves

Bowes Air Hose Couplings—Cleco Never Slip Hose Clamps and Cleco Grooved Hose Nipples and Hose Clamp Tool

STYLE O.F. is an Outside Thread Female Pipe End. Made in sizes ⅜-inch to 1½-inch.

STYLE I.F. is an Inside Thread Female Pipe End. Made in sizes ¼-inch to 1½-inch.

STYLE H.F. is a Female Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼-inch to 1½-inch.

STYLE H.M. is a Male Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼-inch to 1½-inch.

STYLE O.M. is an Inside Thread Male Pipe End. Made in sizes ¼-inch to 1½-inch.

STYLE I.M. is an Inside Thread Male Pipe End. Made in sizes ⅜-inch to 1½-inch.

The Male and Female Ends of Bowes Couplings interchange in sizes ¼-inch to ¾-inch. Sizes 1-inch and 1¼-inch interchange. The 1½-inch ends interchange only with themselves.

BOWES COUPLINGS

Are instantly connected or disconnected.
They are absolutely air-tight under all pressures.
They quickly pay for themselves by stopping costly leaks.
They interchange in sizes most commonly used.
They have no loose parts to be mislaid or lost.
They are made of brass and will not rust.
The U-shaped Gasket interchanges in couplings ¼-inch to ¾-inch.

CLECO VALVES



Style P.O.



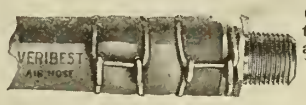
Style M.O.



Style A.

Style P.O.—Made in sizes ¼ in., ⅜ in., ½ in., ¾ in., 1 in., 1¼ in., 1½ in., 1¾ in., and 2 in. Pipe Outlets. Inlets are one pipe size larger.
Style A—30° Angle Valves, are made in sizes ½ in., and ¾ in.
Style M.O. Valve—Has 1 in. Inlet and Bowes Coupling Outlet, Connects with Bowes sizes ¼ in. to ¾ in.

CLECO GROOVED HOSE NIPPLES



Grooved Nipples when attached to the Hose with Wire Clamps as illustrated cannot "blow out." Wire clamp tool shown below applies the wires to hose.

The Lightening Hose Clamp Tool illustrated applies wire clamps at a cost of 1½ cents each.



In stock: Riveting and Chipping Hammers, Air Drills, Emery Grinders, Sand Rammers, etc.

Use Annealed Wire No. 14

IMPORTANT:—The Small Leaks in your "AIR LINE" mean serious loss in DOLLARS. Have you any idea of the amount of "Air" wasted in small leaks at your connections? Air Leakage through 1-16 in. opening equals 5.32 cu. ft. per minute at 80 lbs. It will pay you to install Bowes Couplings and Cleco Valves, which will stop costly leaks.

Bulletins Nos. 43, 44, 46 and 47 mailed on request.

THE MODEL HOSE LINE illustrated shows correct styles of couplings and valve to use and proper way to attach the Cleco Never Slip Hose Clamps to Bowes Couplings. No "blow-offs" can occur when "Cleco" Clamps are used.

CLEVELAND PNEUMATIC TOOL CO. OF CANADA, LIMITED

84 Chestnut St., TORONTO, ONT. **337 Craig St. W., MONTREAL, QUE.**

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Hendey Lathes

In the tool room of a British aeroplane plant this battery of **Hendeys** is giving service of which we are proud. The great accuracy essential to aeroplane parts is readily secured on these **Hendeys.**

Hendey Results Are Sure!

The ability of any lathe to do its work well depends not only on its various labor-saving attachments, but to a very large degree upon the accurate fitting, assembling and aligning of the head and tail stock and carriage with the lathe bed.

A careful and well-rounded system of tests is made on each and every **Hendey** Lathe on the erecting floor before being passed for shipment.

A complete test and inspection record is made for each lathe, a copy of which goes with the machine, showing the customer at once just what results he can expect in the way of accurate turning, boring, and facing from the machine.

When in need of a dependable lathe—remember the **Hendey.**

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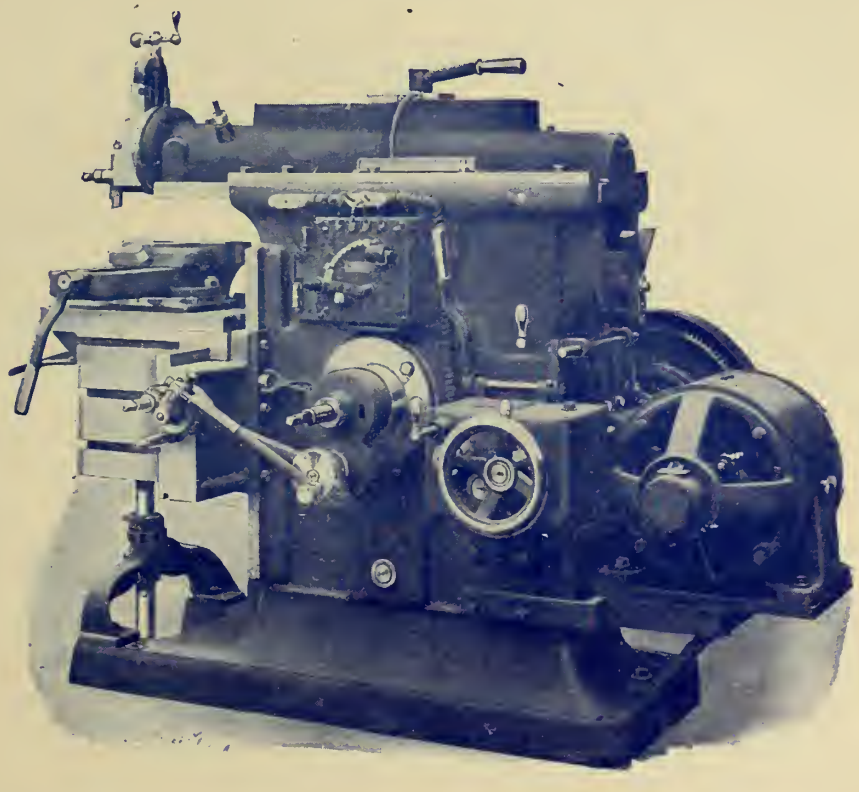
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Permit Changing the Stroke Without Stopping the Machine

No stopping the flow of production with the Smith & Mills. You can change the length of the stroke, whether to shorten or lengthen it, without stopping the machine. You need only loosen locking screw and stop the shaft revolving and the adjustment is made very quickly. The helical gear on bull wheel eliminates shock. A wrist-pin gear, fitted to the bull gear in an eccentric form, replaces the conventional bevel gear arrangement in the bull wheel. It's an ideal shaper for speed and accuracy.



Made in both Belt and Motor Driven Types.

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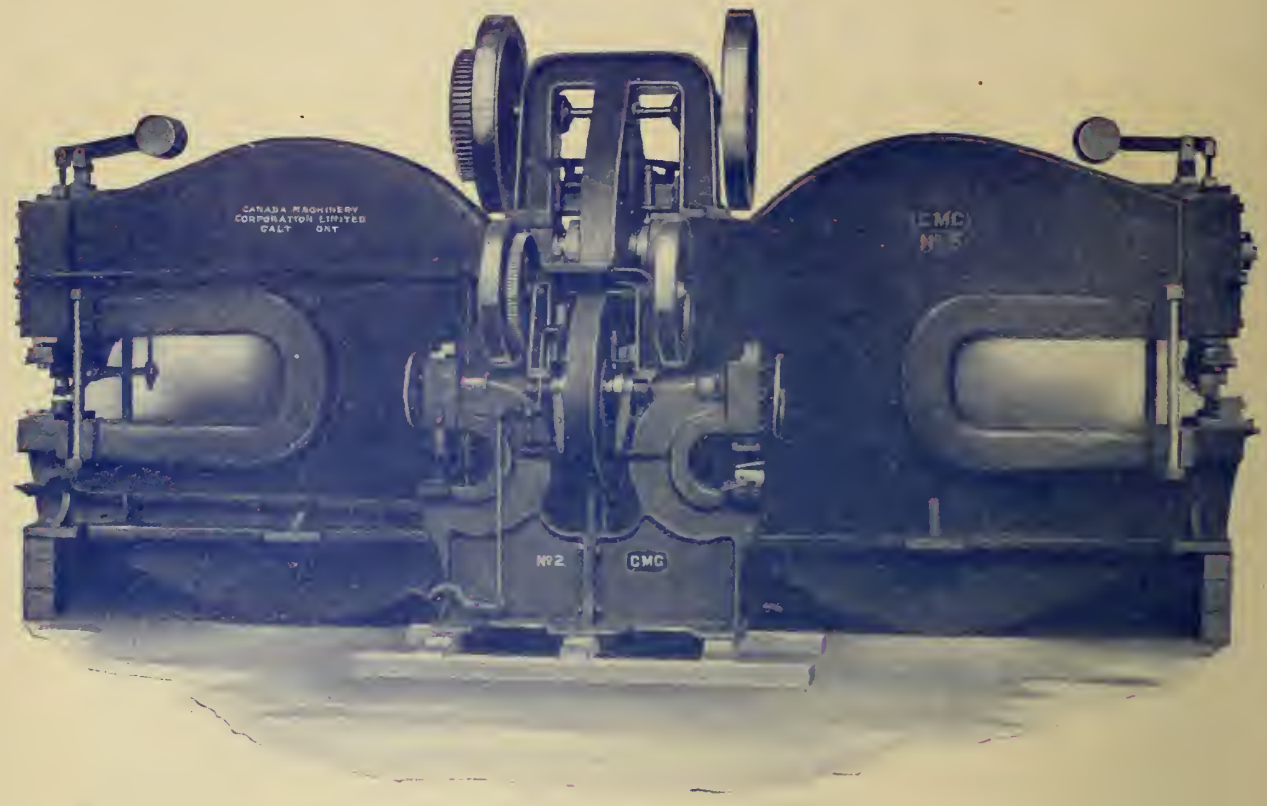
305 St. James St. Montreal, Que.

QUALITY Foss SERVICE

C.M.C.

PUNCHES AND SHEARS

LARGE AND SMALL



A COMPARISON

The above illustration shows two machines recently furnished to a customer of ours. As they were ready for shipment on the same day we had a photograph taken to demonstrate the range in sizes of punches and shears that we are prepared to furnish.

The larger machine is our No. 5 double end punch and shear with 60" throat and which will punch 1¼" holes in 1¼" plate. The smaller is our No. 2 machine with 12" throat.

CANADA MACHINERY CORPORATION
LIMITED

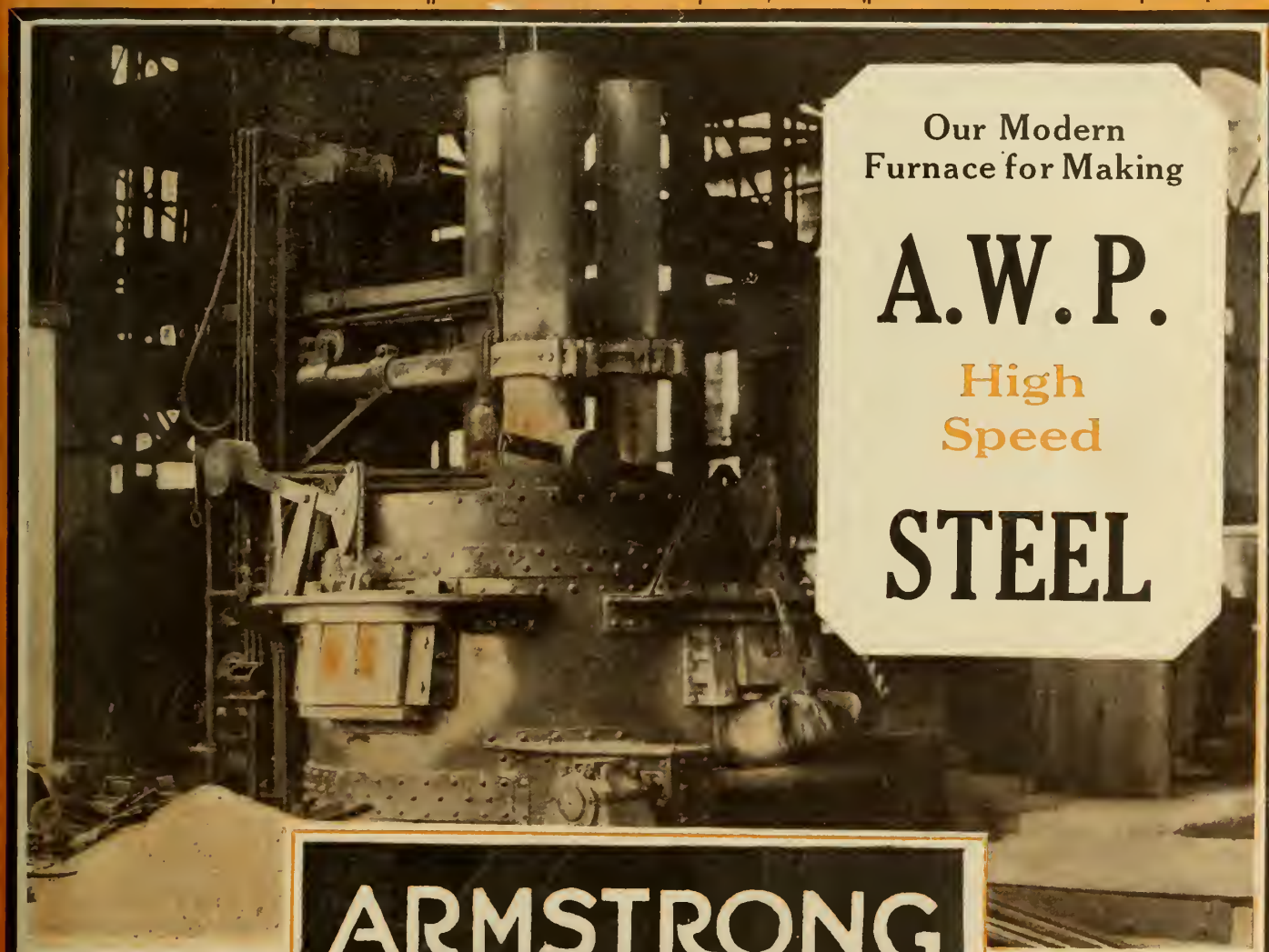
GALT **ONTRAIO**

Toronto Office and Warerooms, Brock Avenue Subway

CANADIAN MACHINERY AND MANUFACTURING NEWS

Vol. XXIV., No. 18 Published by the MacLean Publishing Company, Limited, Toronto October 28, 1920 $4.00 a Year Subscription Price

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Our Modern Furnace for Making

A.W.P.

High Speed

STEEL

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The Better the Man, the More He Appreciates Them—

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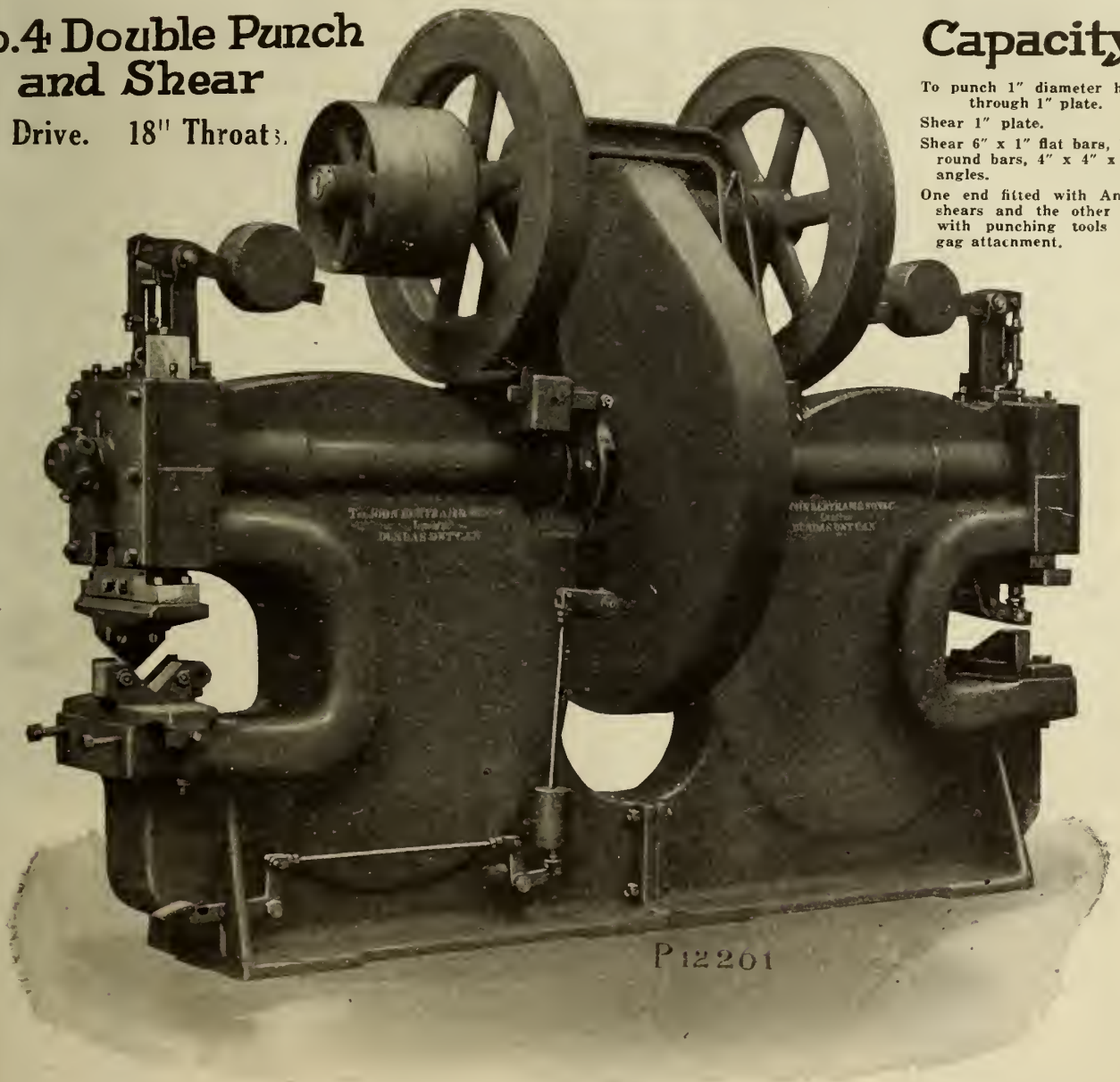
The BERTRAM Page

MACHINE TOOLS

JOB&CO

No. 4 Double Punch and Shear

Belt Drive. 18" Throats.



Capacity

To punch 1" diameter holes through 1" plate.

Shear 1" plate.

Shear 6" x 1" flat bars, 1¾" round bars, 4" x 4" x ⅜" angles.

One end fitted with Angle-shears and the other end with punching tools and gag attachment.

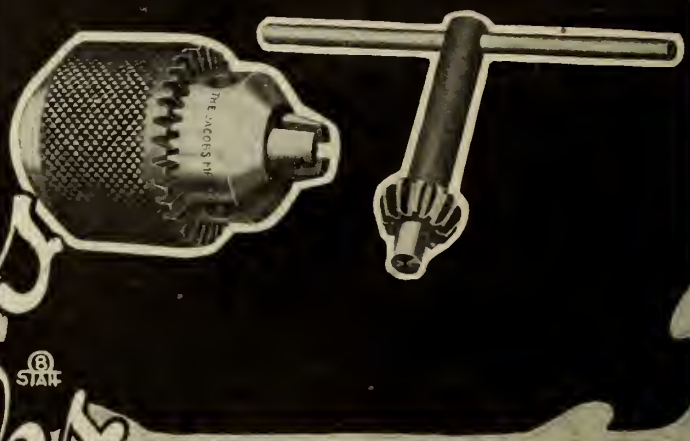
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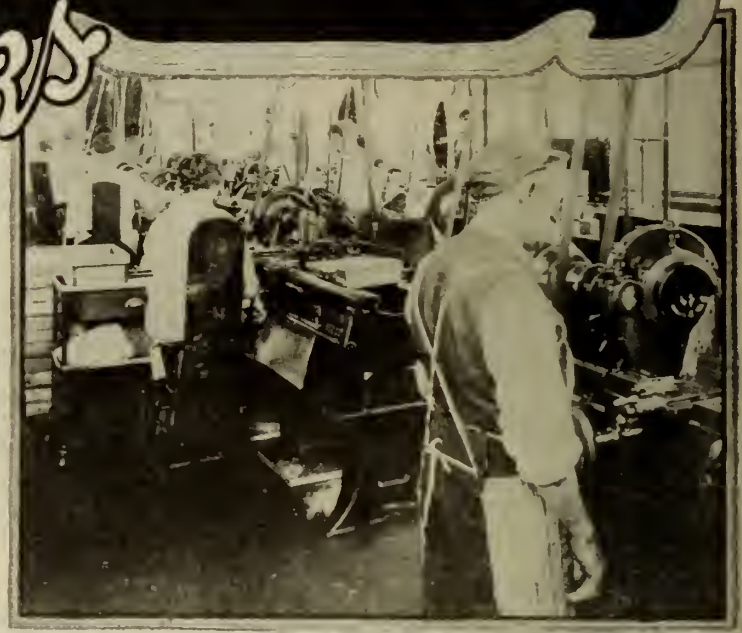
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Mute Evidence

of the remarkable system in the Jacobs Manufacturing Company, Hartford, Connecticut, which enables them to make the most perfect, accurate chucks on the market at the price of ordinary chucks.

This unusual system is directly responsible for the gigantic volume of the Company's business.

It will pay you to feature Jacobs Precision Chucks.

The Jacobs Manufacturing Company

Hartford, Conn.



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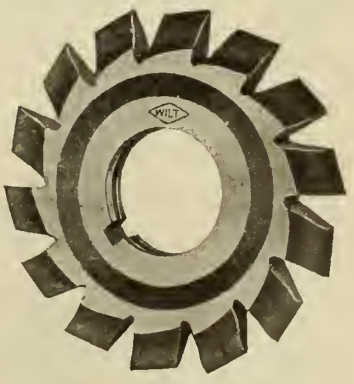
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Your production is regulated by your tools. In these days it is necessary to have tools which are dependable at all times; tools which can be pushed to the limit, and a little beyond; which give long and satisfactory service. Such tools will give you maximum production—and **Wilt High Speed and Carbon Twist Drills, Reamers and Milling Cutters are tools of just this quality!**

Ask your Dealer or write direct for Catalogue "C."



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of Canada, Limited

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Made in Canada

Where there's a WILT - There's the Way.

Trade WILT Mark



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NICKEL

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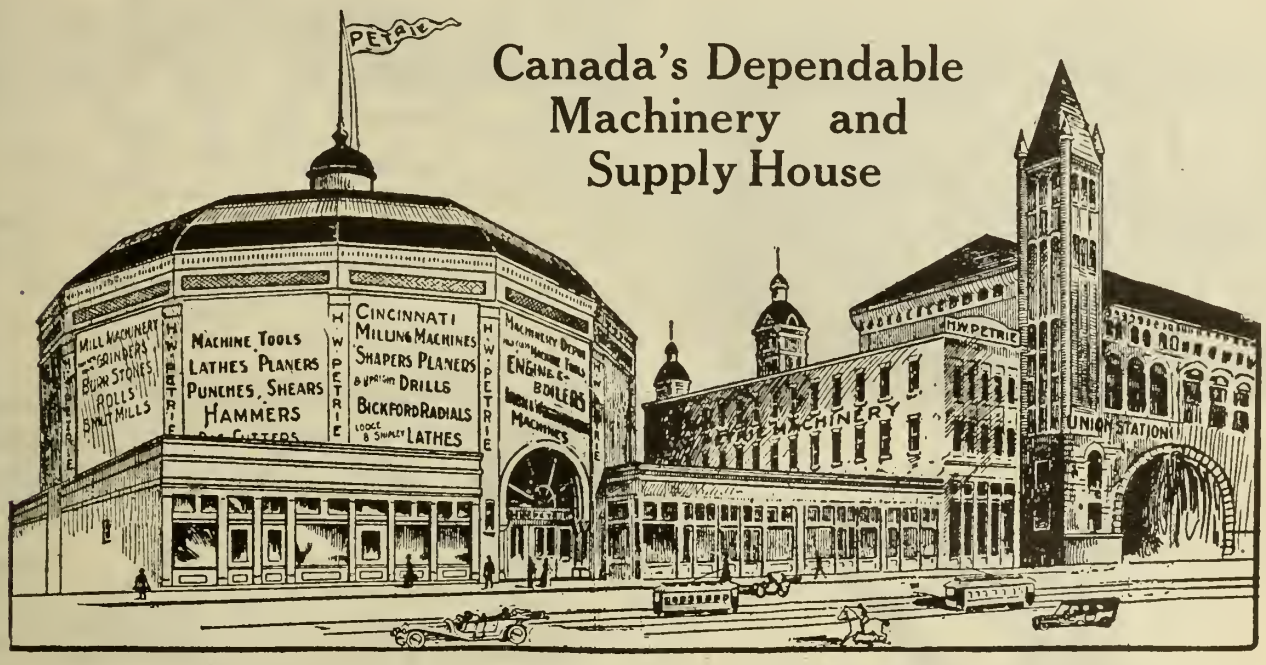
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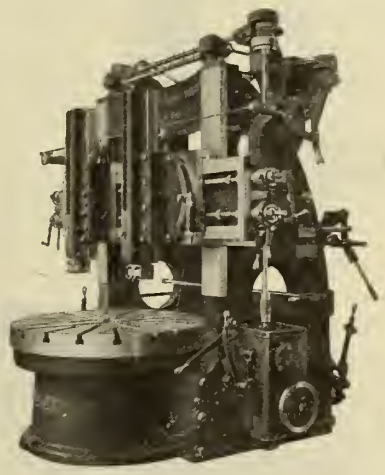
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Made in 5 sizes, from 42 in. to 72 in.

A "Colburn" means Power, Speed, Precision, Economy and Satisfaction.

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Prompt service always from Petrie!

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Prices and Deliveries are Right

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CABLES—ATHENIAN, CANNON, LONDON

STEEL CASTINGS

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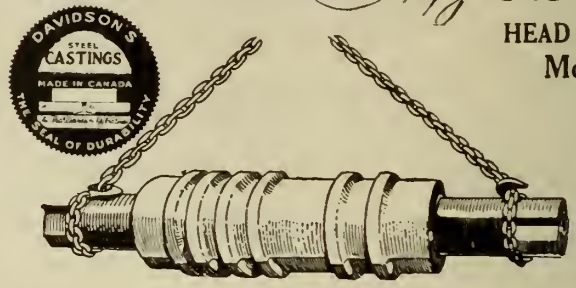
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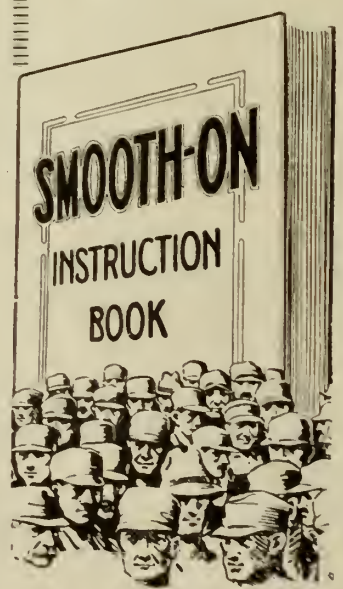
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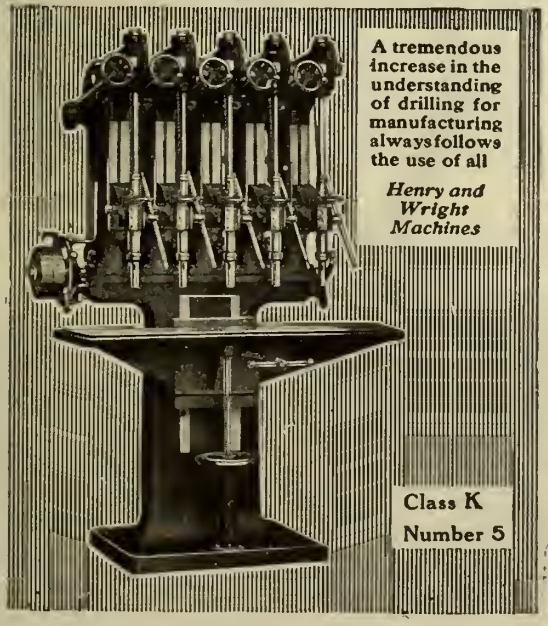
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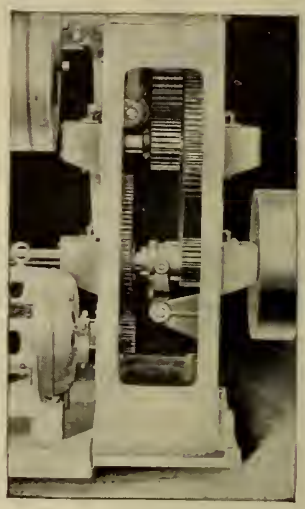
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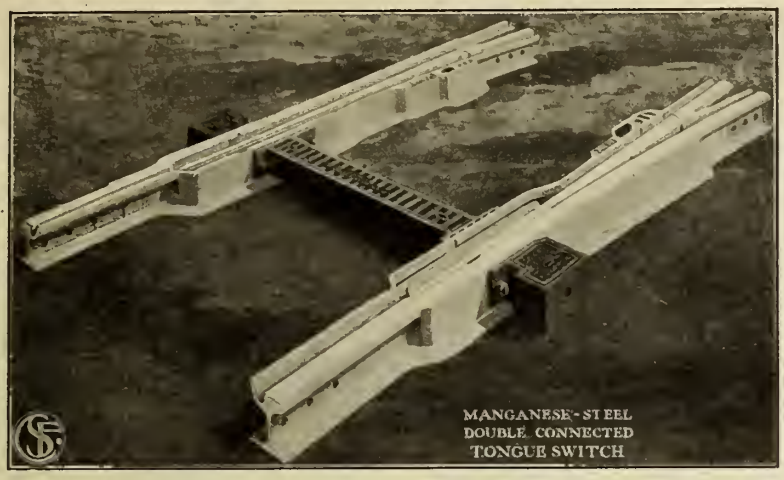


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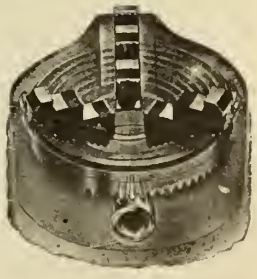
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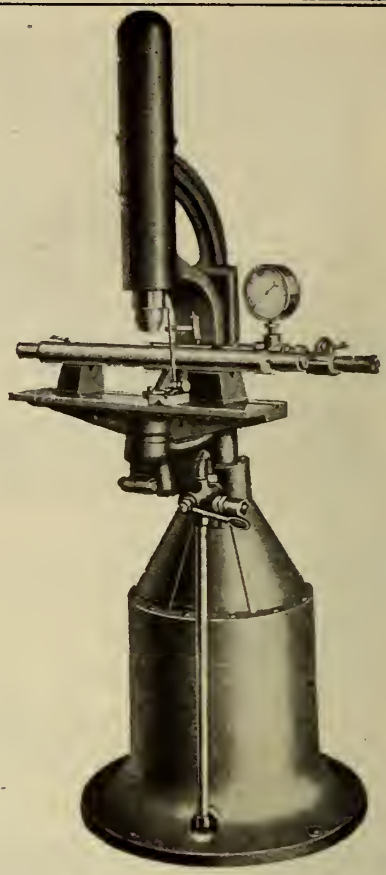
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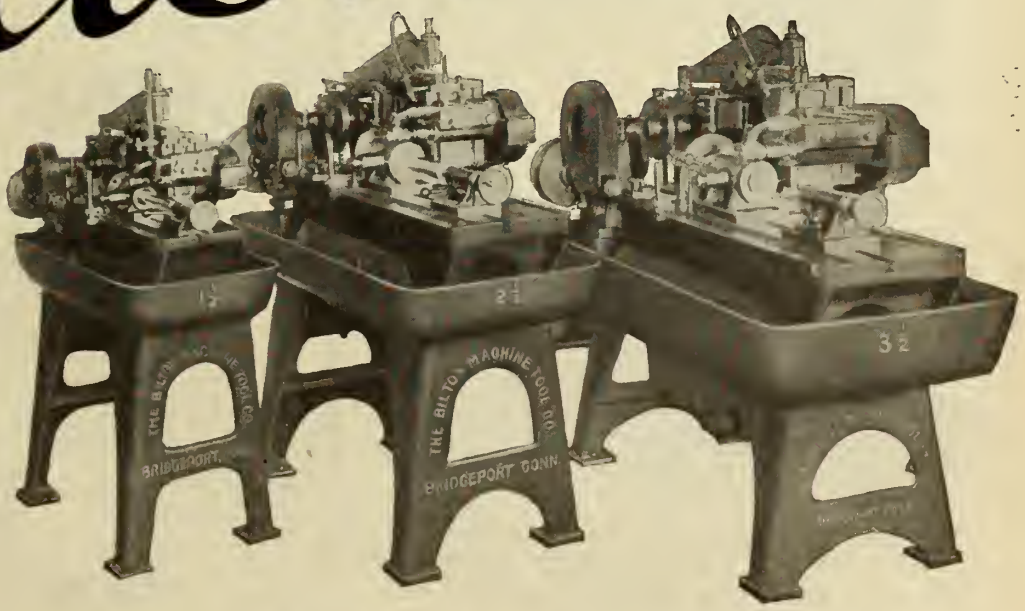
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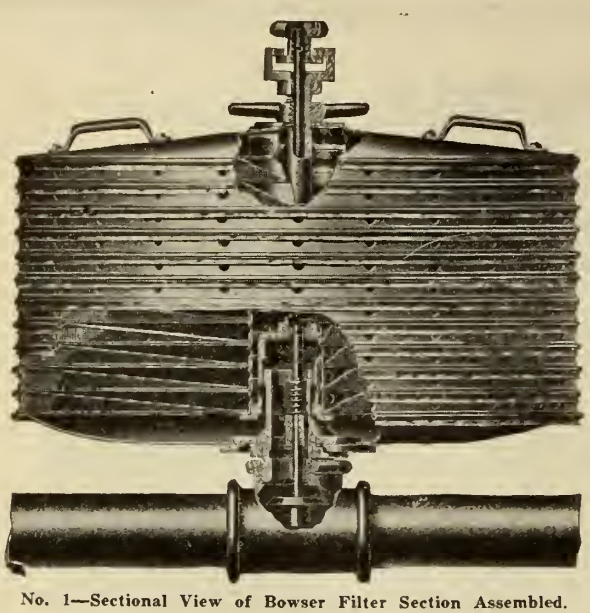
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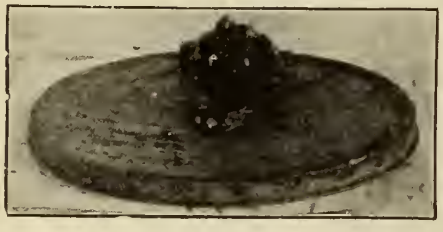
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No. 2—Filter Disc with dirt filtered from oil.

It Gets The Dirt
It's A BOWSER Oil Filter

The pictures shown illustrate the Bowser Filter Section as used in the Bowser Oil Filter.

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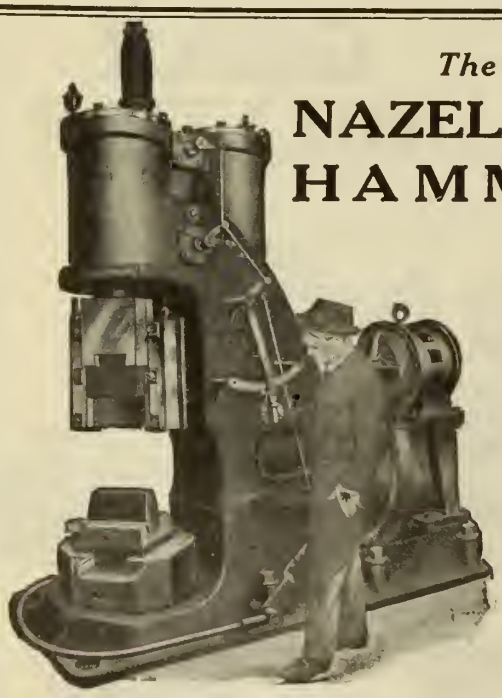
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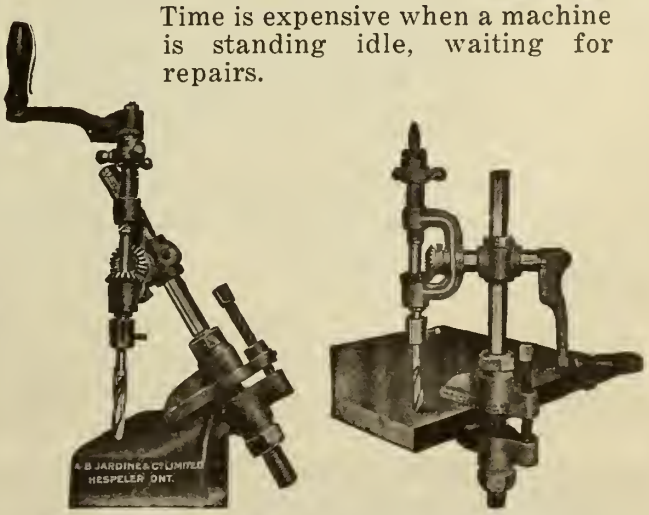
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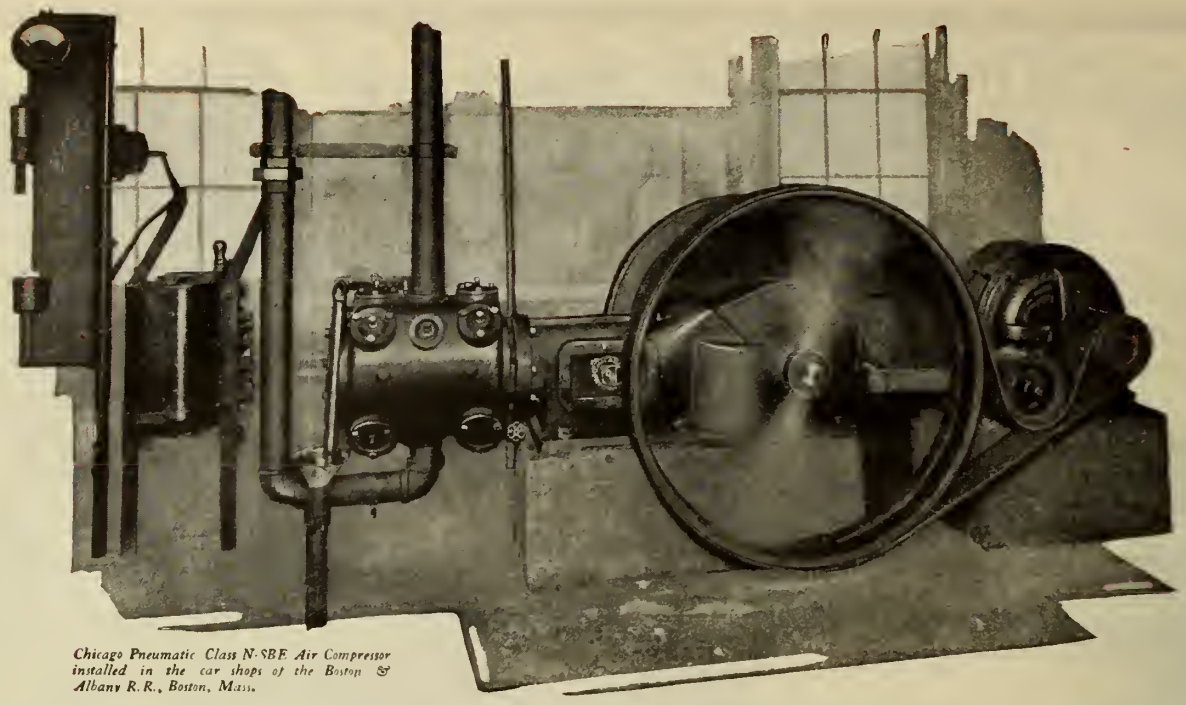
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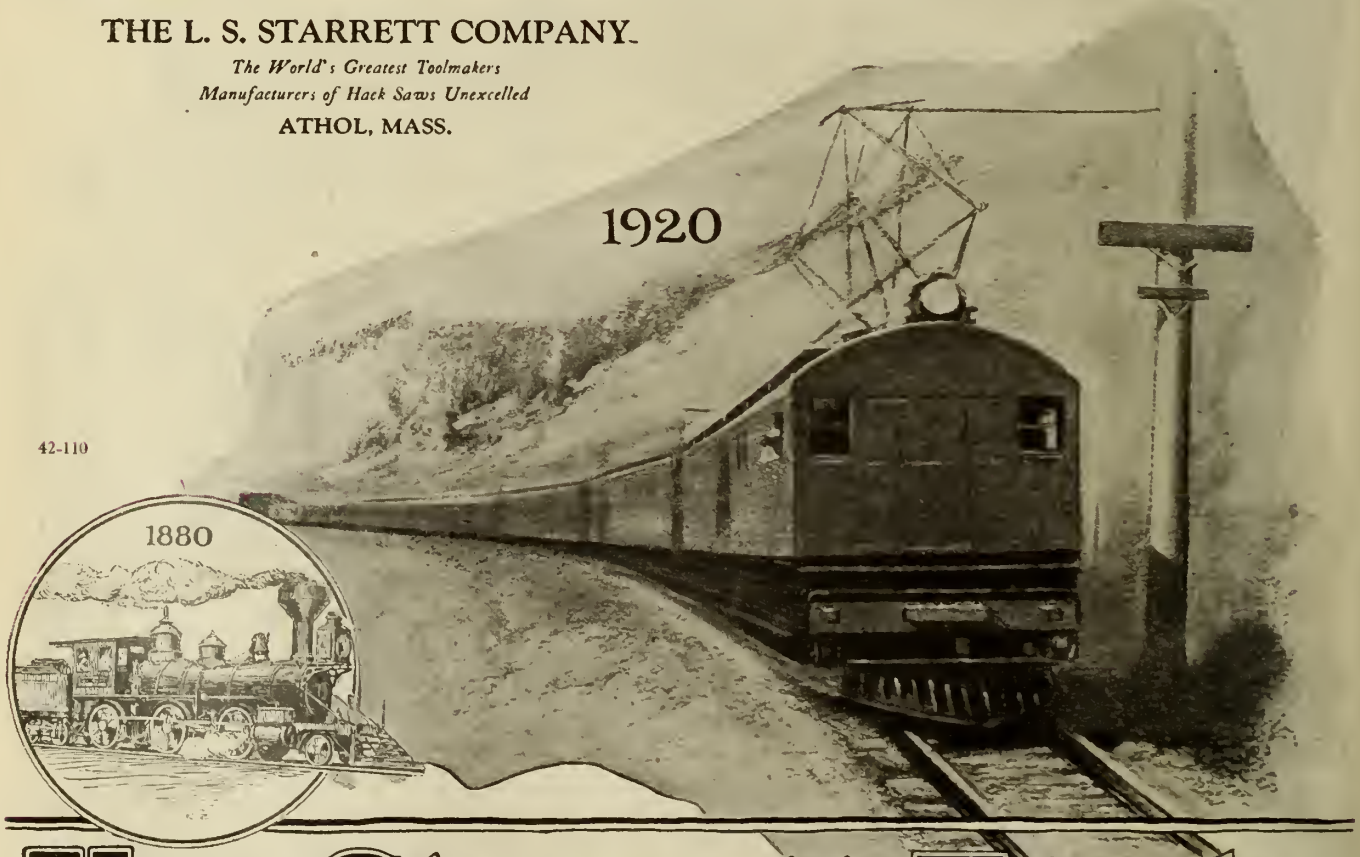
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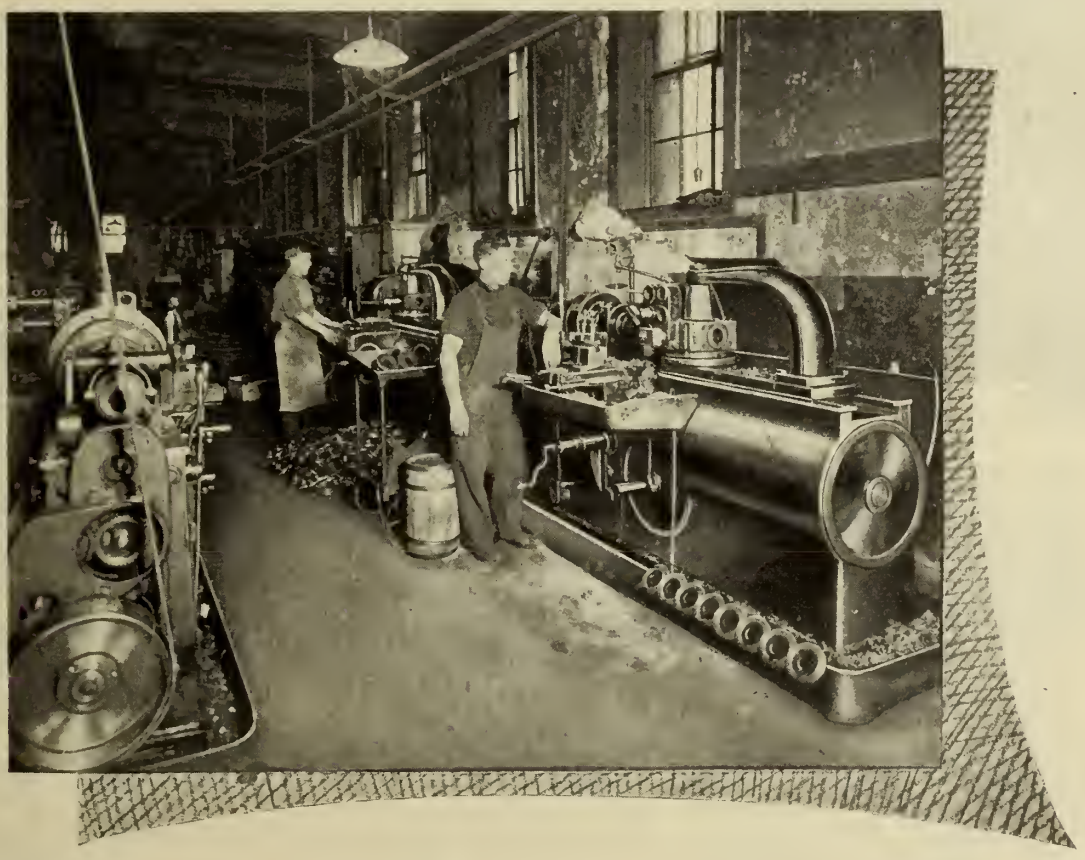
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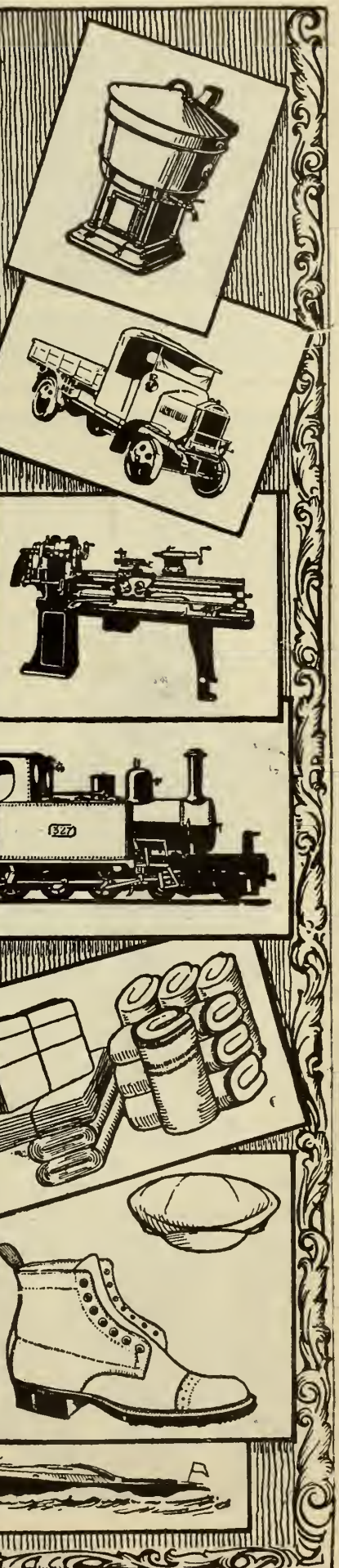
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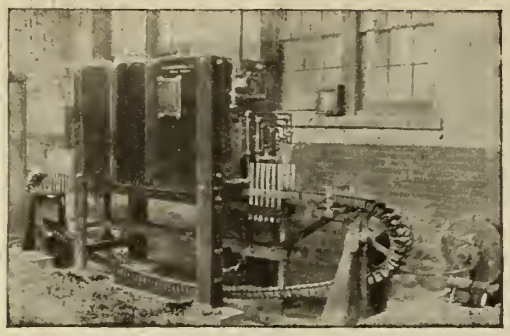
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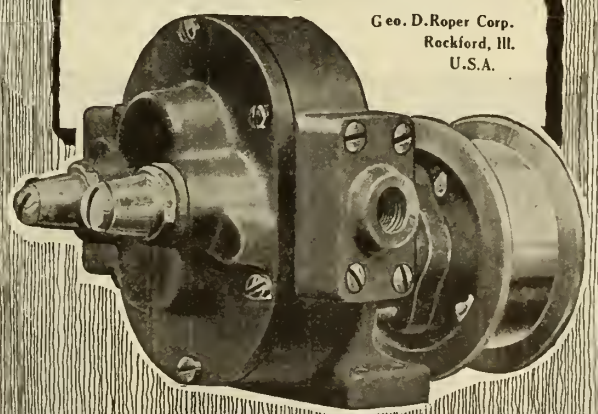
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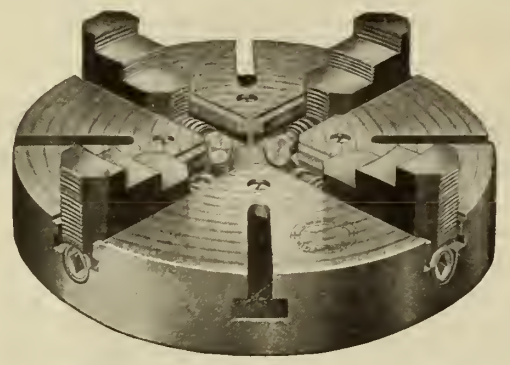
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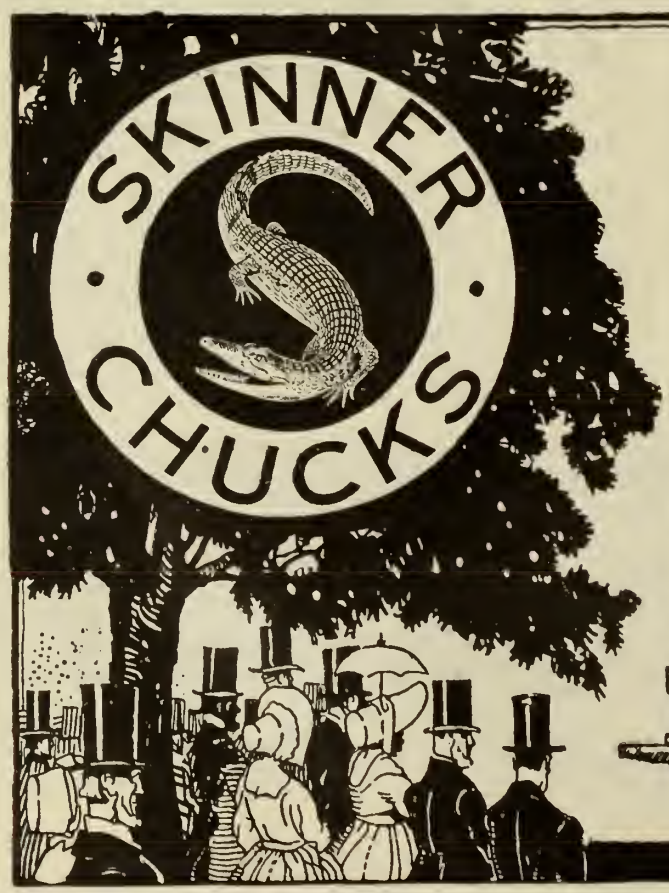
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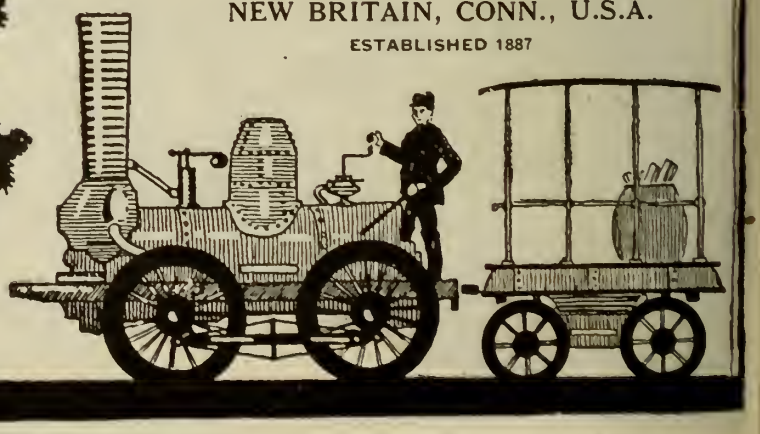
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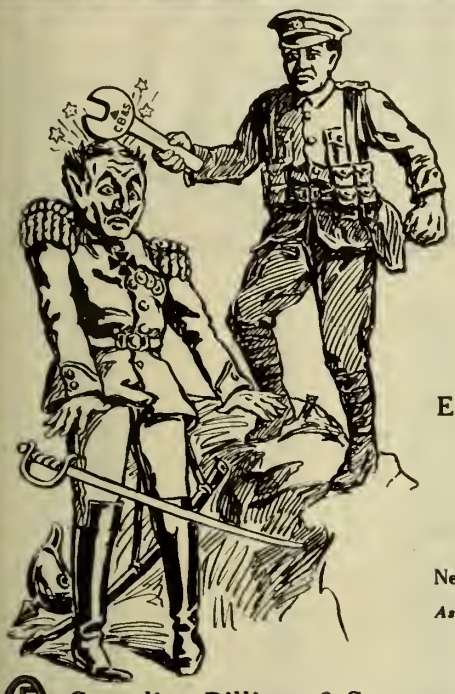
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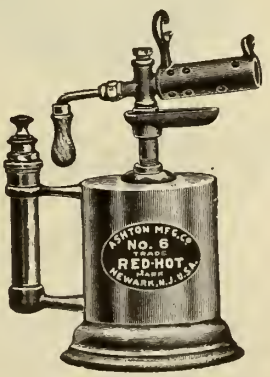
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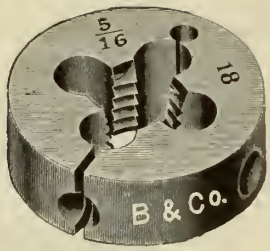
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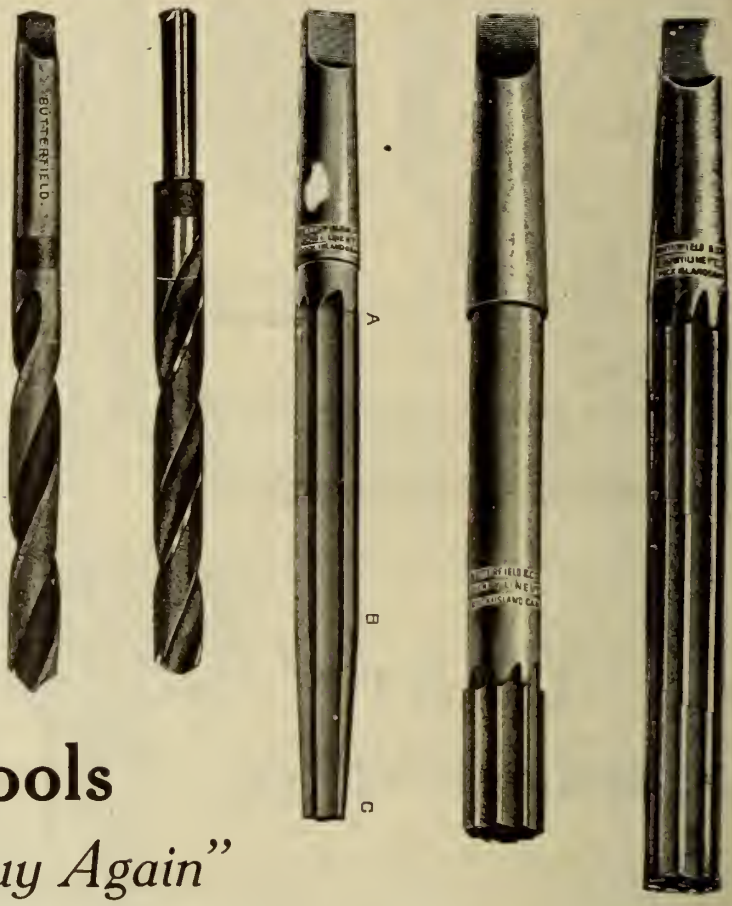
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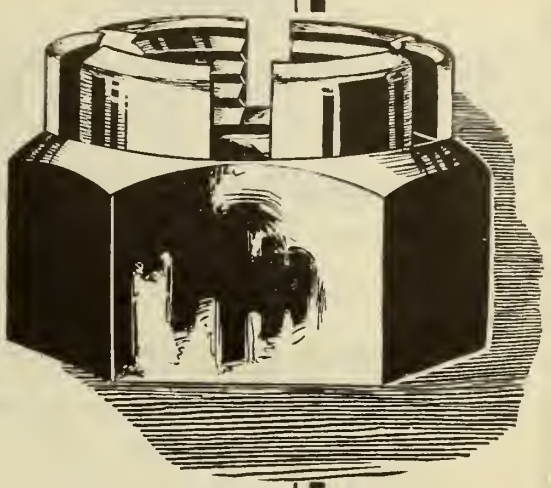
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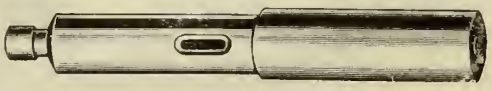
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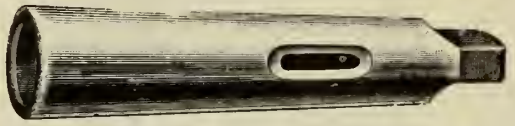
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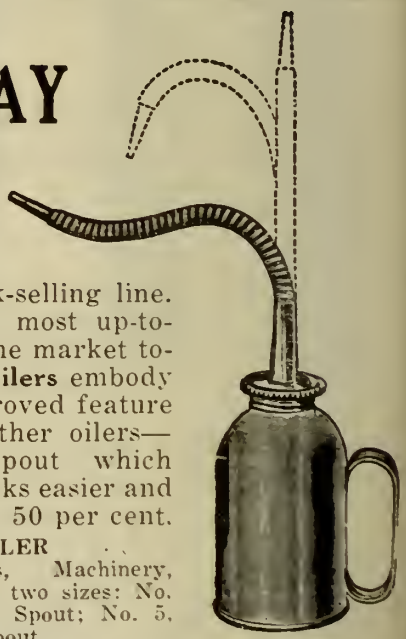
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MATERIAL ..... SEMI-STEEL
OPERATION .....ROUGH TURN GROOVE AND FACE
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TOOL....¾" sq. x 6" and ⅜" x 1" x 8"

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Average Time
STELLITE ..... 6 min.
H. S. S. ..... 8 min. 20 sec.

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Production Increased Approximately 26%

Send For a Demonstrator And Be Convinced

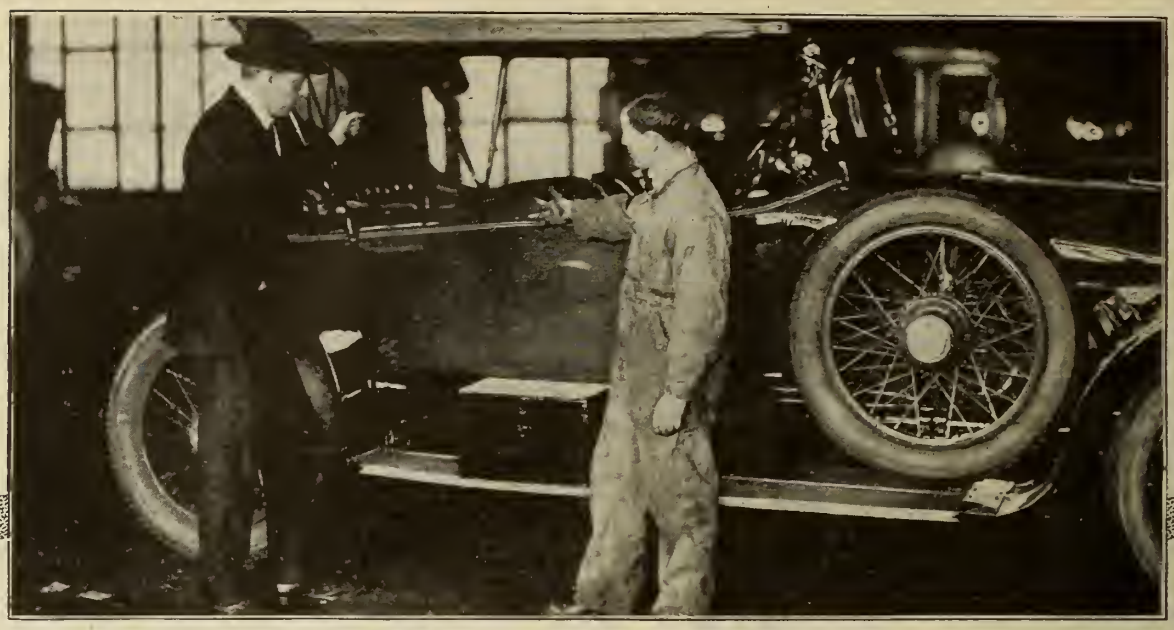
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THE MASTER METAL

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YESTERDAY I dropped in at the B. & B. Auto Top Company's plant at 509 West 56th Street, New York City, to see how the repainting of my old car was getting on. George Rudd, one of the workmen, led me into the shop.

"There she is," he said, pointing to a beautiful car.

"Why, that's never my car," I said in amazement. "It's a brand new machine."

"Your car, all right, Mr. Spencer," he answered with a grin. "Glad you like the job."

"Like it!" I replied, "Why the folks will think I've bought a new car. It's the best repainting job I've ever seen—clear and smooth as glass. Didn't take you long, either."

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"If you use sandpaper for any work around home, Mr. Spencer," he went on, "get hold of some Manning Speed-grits. You'll certainly notice the difference."

Manning Speed-grits

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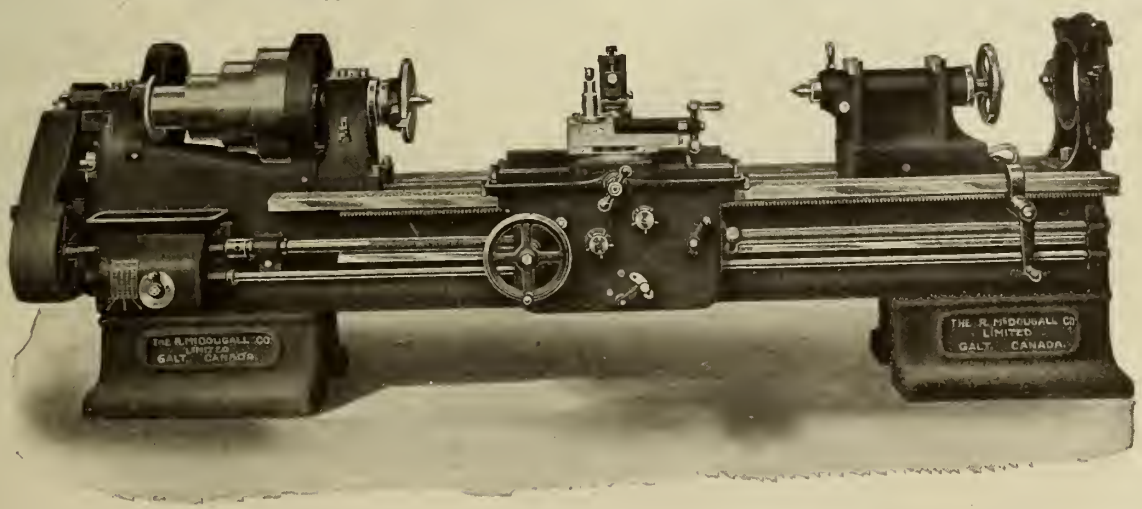


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McDougall Engine Lathes possess all the features which ensure economical production, dependable accuracy, and ease of operation.

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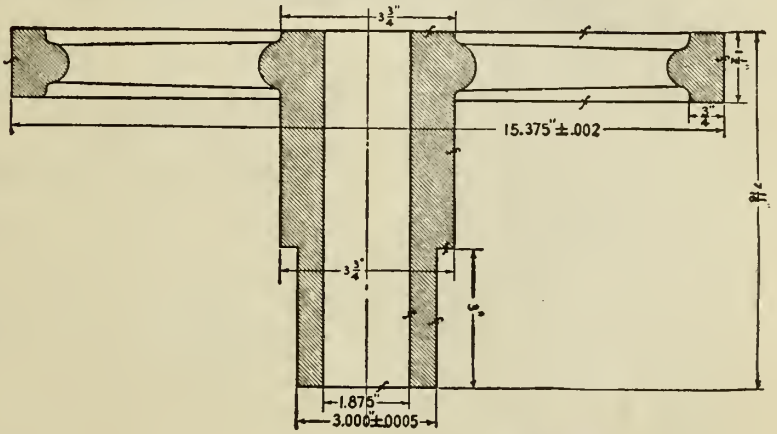
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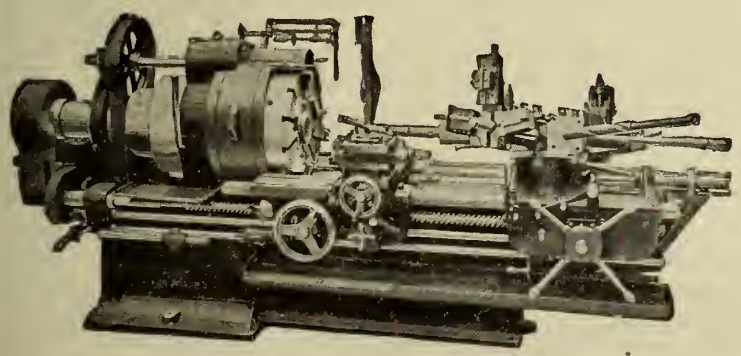
17 MINUTES

This is one of the hundreds of pieces that can be successfully handled on the Standard Gisholt Turret Lathe with the Standard Chucking Tools as shown in the illustration below.

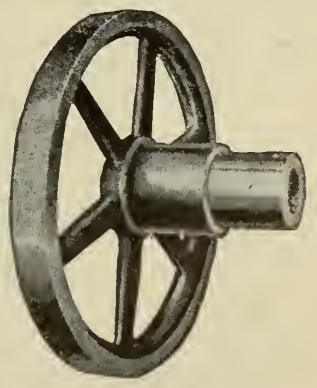
It was finished complete, as indicated by the drawing, in seventeen minutes with the use of Standard Tools only.

Why not gain the advantages of the Standard Tool Equipment on your own work? Think of the increased production.





Standard Gisholt Turret Lathe
Equipped with Standard Chucking Tools



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11



CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XXIV. No. 18 October 28, 1920

Some Interesting Examples of Bulldozer Work

The Uses of a Bulldozer Are Explained, and Four Typical Examples of Work Performed Are Shown—Mechanics Should Become More Familiar with the Possibilities of Such Machines.

By J. H. MOORE

BEFORE going into a discussion of the uses of a bulldozer, and examples of work performed on the same, we will imagine that there are readers who have never watched such a machine in operation. This may appear, to those who are familiar with a bulldozer, like explaining the A, B, C's of the alphabet, but one must remember that many a good mechanic has never entered a forging department, therefore has had no chance to watch the bulldozer perform. It is for the benefit of such readers that we append the following.

Study Fig. 1, not with an idea of looking at the die, but at the machine itself. This view illustrates the main essential working parts of a Williams and White bulldozer. To be brief, this style of machine is used for all types of bending of both hot and cold metals. It consists of a heavy cast iron, or semi-steel bed, with a block or bolster at one end. This block is stationary. The other end has a moving head which slides back and forth on the bed. This head is clearly shown on the photograph. In operation, heavy dies are clamped against the stationary bolster, and on the moving head. These dies are so made that when the moving head comes up to its extreme stroke the form left between the two dies is exactly the desired shape.

The cold bending of course is limited to partly light stock, while very heavy stock is first heated by furnaces in close proximity to the machine. The material is placed on or in the stationary die, when the moving head is back as far as it will go. The operator then pushes his clutch lever, as shown on the photograph, the clutch is released, and along comes the moving head, or ram as it is termed, bending the material as it comes.

This description will no doubt be sufficient to allow readers to grasp the object of such machines. It might be well to add that they are built of extremely strong design and can withstand very hard usage.

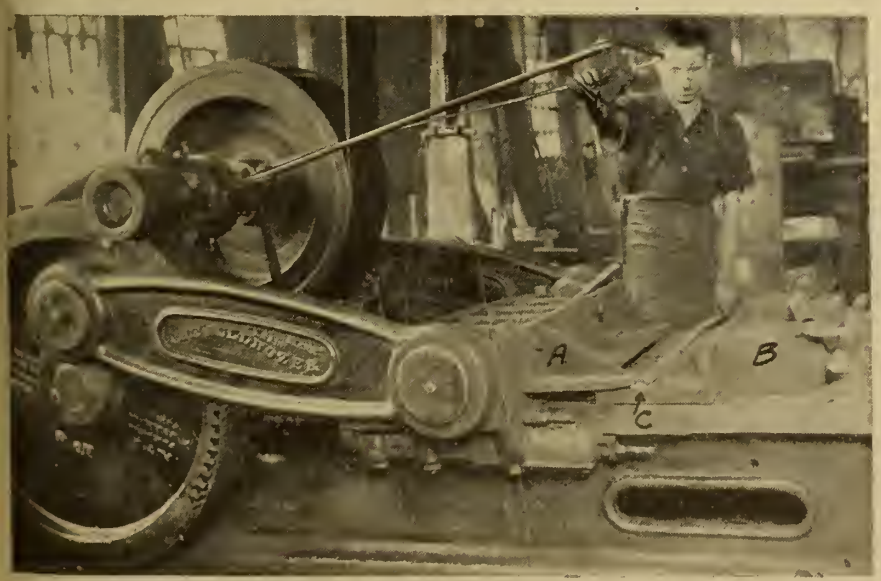


FIG. 1—GENERAL VIEW OF A BULLDOZER, WITH EXAMPLE OF WORK PERFORMED.



FIG. 2—A SPREADING OPERATION. THE STATIONARY PORTION OF DIE ONLY IS SHOWN.

For Forge Shops

The feature as spoken of above makes them ideal for forge shop work, and at the plant of the International Harvester Co., Hamilton, Canada, where these photographs were taken, a great number are in use for all styles of bending. A typical example is that shown at Fig. 1.

The part being bent, or formed, as some express it, is a portion of a harvester. The piece in its finished condition is shown resting on top of the stationary bolster B. The work, before being formed, is illustrated at C. It will be noticed that in this case the work is placed flat on the stationary die, and by close inspection of the photograph the path which the metal will take to fit the die can be followed. A is the moving die. The stock in this case is about 2 inches wide and ½ inch thick. It is first heated, then placed on the die. Near the end of the stock, closest to the line of vision on this photo, is a hole. Advantage is taken of this fact, and the hole is slipped over a gauge pin to prevent the stock moving. This is at the



FIG. 3—A SQUEEZING OPERATION PERFORMED ON BULLDOZER.

end C. The operator pushes the handle, along comes the ram, and a perfect bend is the result. Twelve hundred of these parts are bent in one day.

Spreading Operation

At Fig. 2 is shown a very different style of bulldozer work. A represents a guide for the moving die. We do not show this moving portion as it would conflict with the rest of the view, but its shape can be understood from the nature of the work performed. C represents the part before bending, or spreading, while B shows the finished work.

This piece is made from the U-shaped stock as shown, and the work is gauged from the slot. This is an operation which would be very awkward to perform but for the bulldozer, and when we mention that 300 are completed every nine hours, it speaks well for the efficiency of the operation.

A continuation of the idea is shown at Fig. 3. This illustrates not a spreading but a squeezing operation. Small trunnion supports fit in between these parts, a pile of which can be noticed at right of the photo. After leaving the operation depicted at Fig. 2, the parts are drilled, then passed on to the bulldozer at Fig. 3. Here the operator picks up a trunnion, which has two small pine-like projections on it, and slips these into the two holes at top of piece as shown at A. He now places them in the stationary die, and sets the moving ram in motion. Readers may imagine that the rectangular-shaped nose shown on photo is really squeezing on the piece B. This is not the case, as the nose is really a holding down member and passes directly over the work B, while the die portion of the moving ram comes up and squeezes the work directly to the point where the trunnion pins come through. This might really be termed an assembling operation as the work is all cold. Incidentally it has proved much faster than the old hand assembled method.

Typical Bulldozer Die

The remaining illustration, Fig. 4, is shown more with an idea of presenting the appearance of a complete bulldozer die. C represents the moving die, while the two rams A are attached to this die for guiding and holding down purposes. This system is often adopted to hold the stock securely to the stationary die while being bent. The two portions B are merely housings for the rollers under which the rams A pass. On close inspection of this die a guide pin can be seen toward the left-hand side of the left ram A. D is the stationary die. Another gauge pin can be noted between the two rams A, and somewhat nearer the right hand side.

There are of course more intricate dies made which give a side, and even an angle, motion of separate dies, but for the purpose of this, the first, article on bulldozer work we have touched only on the dies of simpler design. At some later date we will present more intricate problems in buldozer practice.

MOLYBDENUM IN STEEL MAKING

A prominent American metallurgist states that ferromolybdenum is added in a fixed condition. It is supposed to give the steel properties similar to those of tungsten steel, but only one-third to one-half as much molybdenum is necessary that where regular, high-speed steel contains 18 per cent. tungsten, 6 to 9 per cent. of molybdenum may be substituted. However, it gives these properties only when the addition is properly made and proper heat treatment follows. The regulation of these factors caused so much trouble and expense that, in the United States, the manufacture of molybdenum high-speed tool steels has been practically discontinued for several years. It is used for this purpose in other countries however, to a considerable extent. At the present time it is mainly employed in tool steel as an auxiliary rather than as a major constituent. Various reasons have been assigned for the discontinuance of the use of molybdenum.



FIG. 4—A GOOD EXAMPLE OF A TYPICAL BULLDOZER DIE.

How One Shop Maintained its Margin of Profit

It is Not Often We Get a Chance to Print Such Experiences—Contract Work is at All Times a Peculiar Proposition—How Certain Work Was Completed is Told Herein

By DONALD A. HAMPSON

CONTRACT work is like job work in one respect—the margin of profit is so small that it keeps the engineering and production heads constantly on the alert to turn defeat into victory. The way one shop maintained its small margin of profit is told herein and the several instances may present ideas which others can use in their business.

For years it had been a struggle to get castings when we wanted them, and as we would like to have them. The congestion in the grey iron foundry business was so bad that we were obliged to make anything go that we could, even if we had to spend money to re-make the parts after they left the foundry. One great trouble with foundries in general is the lack of attention a casting gets after it is poured. The place is pretty hot by the time pouring starts and the men want to get home as soon as that part of the work is completed which takes any skill. This is where a big mistake is made. Hundreds of dollars worth of spoiled castings could be saved if an intelligent, skilled man were left behind to knock apart the moulds, but the general practice is to have Tony or Mike, the watchman, knock out the castings as soon as he comes on the job, and this he proceeds to do in a heroic manner that leaves all castings in the same state—uncovered, and supported in a still red state, by whatever part may happen to rest on the floor, regardless of how the casting will warp and sag in cooling.

We were building a number of machines that had a "track" that was planed to accurate dimensions. It was the hardest piece to machine we had, because of its length and the inside facing of rows of pads sunk below the general surface. This latter was made worse if the castings were warped, so that the pads cut almost through at one place while barely cleaning up at others. Cautioning the foundry did no good. They were supplied with a straight pattern and requested to be careful about the cooling, but all to no avail, and we continued getting castings that would not clean up.

To make these go we heated them red at the sections of bend, weighted them in various ways, and let them cool off. By so doing we were able to get very straight castings and turn our work out with no delay. A casting so weighted is shown at Fig. 1, which illustrates one "symmetrically crooked"—merely having dropped at the ends.

A Talk on Threading

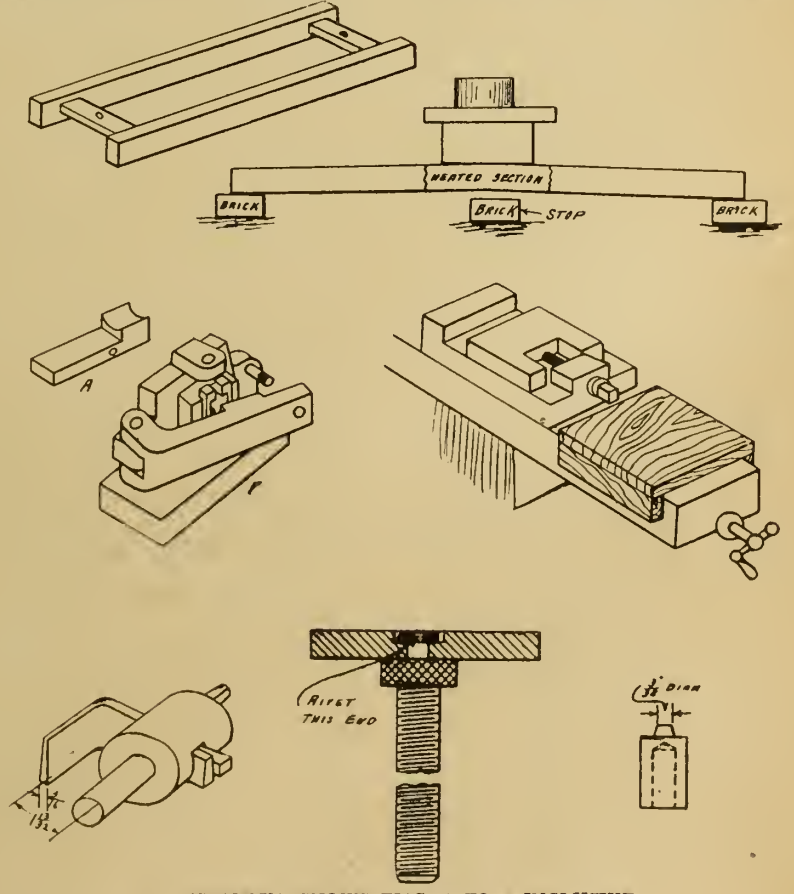
Shops that have to do accurate threading on screw machines or threading machines have been troubled in maintaining a constant lead and in getting a good thread at the end where the die starts. Workmen and executives are apt to think their results and their tools are not as good as those used in other lines and to wonder just how these favored people turn out this perfect work. For instance, they ask, "How do tap makers get such good threads clear to the points of their taps?" The answer is simple. "By selection." Tap blanks are all made up as plug, or bottom, taps and threaded as such. Then an inspector goes over the run and picks out those of poor lead and with poor threads at the start; the good ones are fluted and relieved as plug taps, the poorer ones are cut into taper taps. It is commercially impossible to maintain the production of threaded parts to the highest standard and some such scheme as mentioned saves money without sacrificing needed accuracy. Our shop was making an automotive part on contract, including a screw that was exceedingly hard to keep in shape right up to the end. Our equipment was of the very best. The way we did the work was to set the automatic to make an extra ¾-inch of length and by another operation to cut this part off afterward, it being the only part that had threads that were not acceptable.

Ball Bearings

Our milling department was up to the latest wrinkles in steels and feeds and speeds. Contract work has to be forced where there is clear going. This forcing wears the shoulders of the feed screws and the seat that takes the thrust. It means constant re-facing and collaring. We decided to settle that job once and for all. Each machine, as it was taken out of service for any repairs whatever, was disassembled by removing table, screw and saddle bearing of the screw. Enough material was cut away to permit the insertion of a standard ball thrust bearing of the three ring type, costing around a dollar apiece. Putting this bearing between the shoulder and the cast iron bearing placed all the thrust load on hardened parts. It settled our problem then and there, at very little expense. The first of the millers so changed has now been in daily service for eight years and there is not yet enough wear to make repairs advisable.

Rapid Facing

A customer decided on a change on a dozen presses we were making, substitut-



THIS GROUP SHOWS FIGS. 1 TO 6 INCLUSIVE.

ing a solid 3-inch square steel bar for the cast head piece that was intended to go between the uprights. We got the steel and sawed the bars off, 24 of them in all. As they had to be individually fitted and everyone knows what an uncertain job vertical planed cuts are, we cast our eyes on milling machine equipments that would do the work better and quicker. The photo shows what we found and how it was done. A knee with tongue to fit the table slot was used for both a stop and to align the bars. A single clamp sufficed to hold the work in place. And the inserted blade end mills that we had made to screw directly on the spindle nose for various surfacing jobs were just the proper tool for this work. With plenty of power, we left the



REFERENCE TO THE TEXT WILL EXPLAIN THESE PHOTOGRAPHS.

sawed pieces long, avoiding any loss through a crooked cut, and let the cutter "walk right through the end," as the chips will show.

The piece shown in Fig. 2 is one of a pair used as a split nut in some ten thousand patented devices we contracted to make. It is made of cold drawn steel ⅜-inch square, milled to shape. The half round cut was made with a formed radius cutter, doing the work in a hand milling machine with lever feed, milling one piece at a time. Though production was acceptable, the finish was not, the tendency being to crowd the work past the arbor, springing the latter and leaving the cut shallow and rough. This resulted in slower tapping and broken taps.

A better scheme was worked out as shown at B, Fig. 2. Two pieces at a time are held in a drilling jig, upright, spaced properly and clamped by the hinge. Then a three lip twist drill is passed down through the bushing and cuts the concave in both pieces at once. Greater production and real uniformity resulted at once from this improved fixture. In general, it might be said that outside of manufacturing shops, the advantages of three or four lip drills and the possibilities of drilling vs. other methods are rather overlooked.

Keeping the Miller New

The best practice in milling and planing is to set up jobs at different points on the table—not to set each and every one right in the centre—but nine out of every ten workmen cannot be taught the wisdom of this. This continual centring wears the ways in one short section (for cuts are rarely of capacity length) and it results in uneven wear and abuse of the table. Workmen have a propensity for dropping hammers, wrenches, and miscellaneous junk on the exposed section of the table between the job set up and the front end—they never put them down carefully. In consequence, that section looks decidedly second-hand in less than a month, and no good end has been accomplished from this malpractice. We found it almost impossible to break the men of this habit so, as it is more convenient to keep tools near by, we made up the protection boards for each machine and the men took to them at once. By making the sides a tight fit on the table, the boards hold themselves in position in spite of jar of cutting. If no other good were accomplished, the feeling that the machines were not abused would compensate for the little effort expended. Fig. 3 shows this kink.

The drawing Fig. 4 illustrates an assembly of a screw set into a head piece, and the teat end rivcted over upon a washer in the counterbore, the combination forming a screw that could be turned when desired, but held without an excess of side play. We had been riveting over the teat by hand and we knew all along that we were not getting good work—fully half of the screws were so tight that they had to go through a long loosening process or else they were so loose they had to be sent back, with risk of incurring trouble No. 1 the second time.

The simple fixture shown by the photo is the way in which we turned out a product that "looked as if it was made somewhere." The head piece may be seen under the arch of the fixture, and the lower end of a screw appears below the clamp. This clamp is a bar of steel bent at right angles, the short end having a jaw that holds the screw in a channel, and the long end forming the handle which the boy grasps in connection with the stationary bar, which is nearby; pressure sufficient to keep in place is thus afforded, while as soon as the hand is taken away the work may be removed. The arch shaped main casting is fastened to the drill press table when located by the spindle, fitting in the top and extending up to the tape and tang end, which is driven by th machine spindle. The lower end of th work spindle carries the roller, whic "rolls" over the screw end. Productio was increased four-fold and the reject became practically nil. By giving th head a spin with a finger, the boy know when it still needs more, which he a plies by another pull on the feed lev and another trial up to the point whe the head will not spin but will push.

Trepanning Tool

After we had built and delivered se eral cold heading machines to the wi company's new plant, they wanted change made that involved cutting t three inch holes through the side fran of each, a distance of two inches. machines had been set up but as there was no power in the building a so we had to resort to hand method and in these days hand methods h to be arranged for the easiest possi working.

First we put ⅝-inch holes through the centre, using a common ten-i ratchet. Meanwhile we were mak the trepanning tool shown at Fig. which was to be piloted by the ⅝-i hole and was to cut away a chunk th inches in diameter. And this it did q nicely, using the same ratchet wit pipe extension on the handle. Our perience in cutting tank and boiler pl led us to adopt this method as the l and in preference to a series of sma holes to be finished with a larger to

Spotting Bearings

Go into any garage and watch a scraping a bearing. His can of Prus blue is in constant use. In fact, the age machinist would not know how fit a bearing if he did not have this terial. But a little Venetian red or milion powder mixed with oil will as well. The old school of machin who had to go miles from the nea habitation on a repair job never had Prussian blue—they used a little red or red paint or lamp black—anyt they could find after they got there—n they did good work with it too. Re a marking material is not essential x-

cept on the finest class of work for the bearing spots always show up a visible black or polish that is sufficient. And lamp black is as good a marking material for fine work as any compound that can be bought, and much cheaper.

Concrete Cams

We had a four inch Cleveland automatic and often set it up for as few as a hundred pieces. On several occasions we required feed cams that we did not have and to avoid the expense and delay of these large pieces, we made concrete cams. These served quite nicely. After the machine had been set up in other particulars we would lay out the feed cam in chalk and lead pencil directly on the drum, which was something like three feet in diameter. By turning over the machine and checking the movements we assured ourselves as to the accuracy of our work. Then a strip of 1-16-in. x ¾-in. steel would be bent to follow this contour and wired in place, standing on edge of course. A sheet of wrapping paper would be cut and stuck to the face of the drum to cover the screw holes. Two or three cam screws were greased and inserted to the usual depth, their function being to anchor the cam-to-be. Then using sections of pasteboard for the exterior of the "form," cement was poured (or rather trowelled) on; the procedure being to put the cement on top, cover with pasteboard at the right thickness, fasten the latter securely, and turn the drum until a further portion was on top. The work was left overnight to harden. The resulting cam was solid and secure and had a smooth steel roller face. In point of expense it was highly satisfactory.

Something About Burrs

It is impossible to wholly avoid the process of removing burrs, but in so far as drilled and tapped holes are concerned, two simple means are at hand to avoid this work. Many reamed holes have set-screw or oil holes intersecting them or are intersected by unimportant holes. These unimportant holes should be drilled after the others but before the main holes are reamed, and the tap holes should be tapped before any reaming is done. Then when the reamer is put through, the finished hole is smooth and does not have to be hand scraped or again reamed for the swell that the tap would leave.

The practice of countersinking all holes should be followed; it is a saving of time always, general impressions to the contrary notwithstanading. For ordinary holes a touch is sufficient to remove the burr for tapped holes, they should be countersunk up to or slightly over the outside size; the saving in time and in files will make up for the extra operation. Apprentices trained in the Brown and Sharpe plant are taught early to countersink all holes.

During the war we had a contract that included hundreds of thousands of parts shown by Fig. 5 which were made on the automatics, heat treated, and assembled. The vital part is the little extension, or teat, which had to be hard to resist constant blows without any change of shape, but not so hard as to break or shatter. We had assumed that case-hardened machinery steel would answer the requirements, but tests on the first few thousands proved to the contrary. The few that were strong enough to stand the racket were so hard that they cracked off at the shoulder; the rest, though hard by the file test, battered up in a short time because of the soft interior. The parts had been heated for about 24 hours.

We knew that we could get results by using tool steel, hardening, and then drawing to the proper temper, but this latter material was too expensive both in first cost and in treatment throughout the cutting and tempering. And the proportion of "lost" parts was sure to be greater.

After some trial, we arranged the work satisfactorily. The same machine steel parts were used but they were put through a continuous run of 48 hours in the furnace before quenching. They came out glass hard, of course, but in addition the depth of case went clear through the teat. And the adjacent face of the shoulder was deeply hardened, its state being such that there was no strain at the line where it joined the teat. The parts were hard enough on the surface and far enough under the surface to give the desired backing. They had only to be "let down" to take out the "snap" and become ideal for the work.

The carbonizing transformed the entire end into tool steel at a lesser cost and was then tempered as tool steel would have been. In not a few cases this same process may be followed to advantage; it is reported that a famous file company was short on a certain "shape" and bought three tons of mild steel at 2 cents a pound, which they proceeded to bring up to their standard in a similar manner, and no complaint was ever received, nor did anyone suspect what they were getting.

LUBRICATION AND THE GERM PROCESS

The following is a synopsis of a paper on "Lubrication and the Germ Process," by Henry M. Wells and James E. Southcombe, M.Sc., read at the British Association meeting:

The authors draw attention that the modern view of lubrication on the physico-chemical side is the existence of a residual valency or affinity between the oil and the solid surfaces of the bearing and journal. The problem has, therefore, to be considered as a kind of intimate relationship between the oil and the metal. This is quite a different view to that held by investigators in the past, who thought that the property of "oiliness" so strongly manifested by fatty oils as compared with mineral oils resided in some particular physical characteristic of the oil itself. The modern point of view has been elaborated recently by a number of students of the subject.

The authors have discovered the reason why the fatty or fixed oils possess superior friction-reducing properties to that of mineral oils. They have shown that this is due essentially to the presence in fatty oils of minute quantities of free fatty acids, which are absent in the majority of mineral oils. In consequence of this discovery they have added small quantities (about 1 per cent.) of fatty mineral or organic acids, which are easily accessible and relatively cheap to hydrocarbon oils. The products so obtained possess remarkably low frictional co-efficients. As an example, the addition of 2 per cent. of common fatty acid to a mineral hydro-carbon oil reduces the co-efficient of friction shown by this oil on a friction testing machine from 0.0084 to 0.0052—a diminution of 26 per cent.

By suitably choosing the type of fatty acid to be added to mineral oil, the behaviour of oils in the presence of water and other contaminating substances can be modified at will. It is also shown that the risk of metallic corrosion is even less with these oils than the usual compounded oils, because the latter frequently develops in working notable quantities of free acid.

The principle of making mineral lubricating oils possessing increased frictional properties by adding to mineral oils suitably chosen fatty acids in relatively minute amounts has been patented throughout the world, and has been somewhat fancifully called the "germ process," because the fatty acid is the germ of the idea.

The value of the process lies in that oils possessing friction-reducing properties much superior to mineral oils can be prepared at relatively little extra cost to mineral oils. Secondly, by this means an immense quantity of fatty oil suitable for the manufacture of margarine and other foodstuffs is liberated for the country's needs and substituted by a much smaller amount of commercial fatty acids, which are quite unsuitable for food and are more or less in the nature of a by-product.

Finally, it may enable the lubricating oil manufacturer to produce the highest class of friction-reducing oils from comparatively thin — therefore cheaper — mineral oils, and incidentally this may have the utmost significance to-day, when we are striving to foster and develop the mineral oil production of our own country and the Empire.

ERRATA

In our August 12th issue we published an article entitled "Can We Avoid Grinding Wheel Accidents?" In the third paragraph from the bottom of the last column on page 159 the term "exposure between the flanges" should read "outside the flanges," and not the word "between." The wording used was rather confusing so that we call readers' attention to this matter.

Manufacture of Helical Springs for Heavy Duty

In This Age of Mechanical Design, New Problems Arise Continually in the Use of Springs Demanding the Highest Possible Quality—Herein is Shown an Example of Spring for Extreme Heavy Duty.

By T. D. LYNCH, Research Engineer Westinghouse Electric & Mfg. Co.

SPRINGS of great variety of design and quality have been manufactured from flats, rods, ribbon and wire during the ages past. Some of them have been heat treated before forming, others after forming and still others have had no heat treatment, the high elastic properties being given to the latter by the work done in cold rolling or drawing the raw stock to its finished size.

Early spring making was for the use of buggies and spring waggons, then for clocks, watches, cars, locomotives, etc., and still later for automobiles. To the automobile manufacturer belongs the credit for the development of the superior quality of springs now used in the construction of automobiles. This progress, however, has not been without concentration of purpose relative to both material and treatment and each step has inscribed its mark of success or failure.

In this age of mechanical design, when every ounce of strength is exacted from each member, new problems arise continually in the use of springs demanding the highest quality possible to produce. To meet this growing demand for quality, every phase of spring manufacture must be co-ordinated and carefully processed at the furnace, at the rolling mill and at the spring making plant.

The steel maker has offered his carbon spring steel made in large open hearth furnaces, which has its field of application but is not strong enough for the most severe conditions that must be met at this time. Chrome vanadium steel, silico-manganese steel and chrome molybdenum steel have much higher elastic properties and are capable of withstanding proportionally greater stresses. Therefore, these and other alloy steels must be considered in connection with this high class work.

Springs for Heavy Duty

Within recent months one of the writer's duties has been to assist in the procurement of helical springs for a unique and unusually severe duty. The accompanying photograph shows the general problem involved, which consists in the transmission of the driving power of a motor to the wheels of a locomotive through a set of cushion springs. The arrangement is such as to permit free vertical and lateral wheel play. In this application the stresses are tension, compression, torsion and shear, separately or in combination, and these stresses are augmented from time to time by shock, producing a condition that makes necessary a material of high elastic strength, and, at the same time, a large degree of toughness.

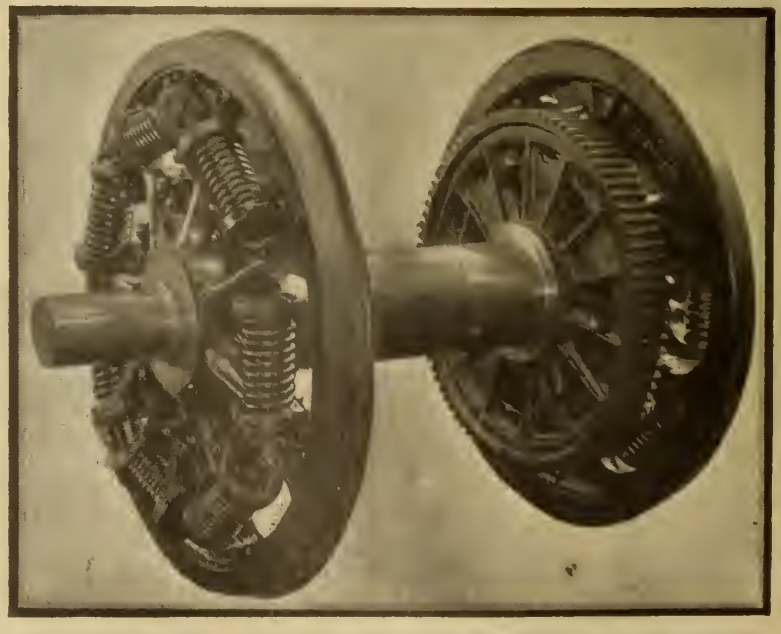
The first step in the study of this problem was to investigate the general practice of spring makers—to find that the general process in vogue for the manufacture of springs from bars larger than 3-8-inch diameter is to obtain the bars from the steel maker, produced in large open hearth furnaces, rolled in a commercial manner, representing tonnage production. Bars thus made are heated to a temperature varying more or less from a bright to a dull red at different parts of their length, coiled into springs and quenched from this irregular coiling temperature. It is needless to say that springs made by such a process cannot be depended upon in severe service.

A few spring makers have realized the need for greater care in making and heat treating springs for heavy duty and a receptive attitude towards better spring making is now being taken by them. Spring steel, and especially alloy spring steel, cannot be too carefully made, nor can it be too carefully coiled and treated in order to produce a strictly reliable finished product. Therefore, let us assume that the steel is carefully made and rolled into rods by the processes known to the steel makers as their best, coiled into springs at a proper and uniform temperature and finally treated by steel treaters under their best practice. Only such manufacture and treatment can be expected to give us the very best results. This hypothesis being granted, let us propose a process for consideration, covering the manufacture of a silico-manganese steel spring made from 1-inch rounds, including the making and rolling of the steel, the coiling, treating, testing and inspection of the spring, in order that we may procure the reliable quality above indicated.

There are many alloy spring steels on the market, any one of which would require similar care in their making and fabrication, but for this article we have chosen a silico-manganese steel. The question now arises how should a spring of the highest quality be processed, including the chemical composition, manufacture of the steel, rolling of the billets and bars, heating and coiling of the spring, the heat treating, inspection and general care required throughout the different steps in order to produce the most reliable product. The following process has been worked out and is submitted for criticism and suggestions from those who may have similar problems to solve.

Chemical Analysis

The steel shall be what is known as silico-manganese steel of the following chemical analysis, both on ladle test and check test from finished rolled



HEAVY DUTY SPRINGS USED ON THE WHEELS OF A LOCOMOTIVE.

bars: Carbon .50-.60, manganese .60-.80, phosphorus not over .04, sulphur not over .04, silicon 1.90-2.20.

The steel shall be made by the crucible or electric furnace process and by a company that has been known to have produced high quality spring steel of the class specified. The ingots shall be not less than 9 inches square at large end and 8 inches square at smaller end, so poured and the molds so coated as to give a smooth surface to the ingot. Each ingot, when cold, shall be carefully inspected and any blemishes shall be chipped or ground out, leaving a surface that will be free from laps or seams after rolling.

Rolling of Rounds

The ingots shall be slowly and carefully heated to approximately 1,100 degrees Centigrade and rolled or forged to squares of approximately 3 inches by 3 inches and sheared into suitable billet lengths for final rolling. Excessive reduction will not be permitted. Sufficient discard shall be made so that no signs of piping or segregation can be found and a very careful inspection made, especially of the top cut.

The billets shall be allowed to become cold and a very careful inspection made for surface defects and any slight blemishes ground out, leaving a smooth, even surface, no ragged corners or slivers being permitted. The billets shall then be heated to approximately 1,100 degrees Centigrade and rolled to finish size, great care being taken to avoid excessive reduction at any one pass.

The bars shall be sheared to length and carefully inspected for piping, segregation and surface defects. Each bar shall be straight, free from surface cracks, scratches, seams, folds and indentations and shall be true to section. The diameter of the bar shall not vary more than two and one-half per cent. from that specified.

All bars shall be tied in bundles and a metal tag securely attached to each bundle. The tag shall have stamped on it the requisition number, heat number, size of rod and manufacturer's identification mark. When bundles are opened great care must be exercised so as not to nick or in any way injure the bars. A nick or scratch in a bar, however small, can not be permitted.

Coiling of Springs

The bars shall be heated slowly to a uniform temperature of approximately 925 degrees C. (1,700 deg. F.) and immediately coiled over a mandrel preheated to at least 100 degrees C. The mandrel shall not be water cooled nor shall any water be allowed to touch the spring while hot.

Notching for length shall be done at a dull red heat and in such a manner as not to cut, scratch or otherwise injure the surface at any other point on the spring. The springs after notching shall be allowed to cool slowly and uniformly in such a manner as to prevent local chilling which may cause surface stresses or cracks to form.

The springs shall be slowly and uniformly preheated to approximately 700 degrees C. (1,290 degr. F.), transferred to a furnace held at a quenching temperature of 900 degrees C. (1,650 deg. F.) and uniformly heated as near as possible to this temperature and quenched in oil. The quenched spring shall be drawn in a salt bath at approximately 455 degrees C. (850 deg. F.) to relieve quenching stresses. The drawn springs shall be cleaned from the adhering salt by a hot soda wash, followed by an oil or lime dip to protect them from corrosion.

Physical Properties and Tests

The properties specified below shall be determined in the order given. The spring shall not be rapped or otherwise disturbed during the test.

Solid Height.—The solid height is the perpendicular distance between the plates of testing machine when the spring is compressed solid with a test load of at least 125 per cent. that necessary to bring all the coils in contact. The solid height shall not vary more than 1.5 per cent. from that specified.

Free Height.—The free height is the height of the spring when the load specified in paragraph (a) has been released, and is determined by placing a straight-edge across the top of the spring and measuring the perpendicular distance from the plate on which the spring stands to the straight edge, at the approximate centre of the spring. The free height shall not vary more than 1.5 per cent. from that specified.

Loaded Height.—The loaded height is the distance between the plates of the testing machine when the specified working load is applied. The loaded height shall not vary more than 1.5 per cent. over nor more than .75 per cent. under that specified.

Permanent Set.—The permanent set is the difference, if any, between the free height and the height (measured at the same point and in a similar manner) after the spring has been compressed solid three times in rapid succession with the test load already specified. The permanent set shall not exceed .4 per cent. of the free height.

Hardness Tests.—The Brinell hardness number shall not be less than 375 nor more than 450. This test shall be made on the coupon resulting from notching to length and broken off after spring has been heat treated.

Structure.—The grain structure of the finished spring should be troostitic or troosto-sorbitic.

Dimensions

The springs shall be straight, with uniform pitch, and shall remain straight throughout the working range. The diameter of single coils of the spring shall conform to the tolerance given on the drawing. The concentricity of the coils of the spring shall be determined by means of a plug-gauge and ring-gauge, extending the full length of the spring, "D" is specified outside diamesions:—

	Length of Spring	
	10" or less	Over 10"
Outside diameter of ring gauge	d minus .063	d minus .094
Inside diameter of ring gauge	D plus .063	D plus .094

where "d" is specified inside diameter of spring. "D" is specified outside diameter of spring.

When the drawing specifies a spring with ends squared and the spring is placed with either end on a flat plate, its axis shall not make an angle of more than 5 degrees with a perpendicular to the plate.

Springs varying from the required finished dimensions may be reheated and reset but all such reset springs shall be completely re-treated—that is quenched and drawn again.

Tests and inspection shall be made at the end.

Packing and Marking

All springs shall be plainly marked with serial numbers and manufacturer's identification letter at one end of the finished spring and on each coupon resulting from notching to length. The purchaser shall assign the serial numbers to be used with each order. Each size of spring shall be packed separately in such a manner as to protect the springs from injury during shipment.

Each package shall be plainly marked as follows:—Requisition number, P. D. Spec. No., number of springs, style number of spring (or drawing and item number if there is no style number), name of manufacturer.

For example:—Req. C-5,100; P. D. Spec. No. ; 6 springs; style No. 591,500; Blank Company.

Tests and inspection shall be made by the purchaser at the place of manufacture prior to shipment. The inspector representing the purchaser shall have free entry at all times while the contract of the purchaser is being performed to all parts of the manufacturer's works which concern the manufacture of the springs ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the springs are being furnished in accordance with this specification.

This paper has included more than the heat treatment of springs and is intended to emphasize the great importance of a better knowledge of complete spring manufacture and bring together on common terms the designing engineer, the steel maker and the spring maker.

A full discussion of this article is desired, hoping that the combined experience of the members of this organization or others may bring out additional data that will assist in establishing a complete and efficient process for the manufacture of truly reliable springs for heavy duty. It is further hoped that this paper has shown the need of coordinating the talent and experience of the men at the steel mill, rolling mill and spring coiling plant as well as the heat treating and testing of the finished product.

Conley Continues Along the Road of Experience

John's Trials Are Varied—He Performs a Bit of Dentistry, Spoils a Job, Then Finds Out Why He Spoiled It—He Hears of the Peculiarities of Cast Iron, Etc., Etc.

By J. DAVIES

AFTER John had been in the shop for six months his father said jokingly to him, "I suppose you have learnt all there is to learn in the shop by this time." To which John replied, "Not much. I have just been in the shop long enough to find out that I don't know anything."

"If you have found that out in six months you are making pretty good progress. It takes some men six years to find it out and some never do. What have you been doing to-day?"

"I have been doing a bit of dentistry to-day. Some teeth were broken out of a lathe gear and I had to put some fresh ones in."

"How did you manage it?"

"Mr. Smith had the fragments of the broken teeth chipped out, and the spaces filled up with the oxy-acetylene welder, then acting under instructions I bolted the gear against the angle plate and marked around two of the teeth on the angle plate. I next ground a tool to fit one of the spaces I had previously placed at the top. I now put the tool in the tool post, fitted it correctly into the space, and tightened it up firmly, setting the indicator for depth at zero.

"I next loosened up the job and turned it round until the broken part came under the tool, and two of the good teeth coincided with the marks I had put on the angle plate. All I had to do after this was to feed the tool down to the zero mark, which indicated the depth, and repeat the operation as many times as there were teeth to be replaced."

"That sounds pretty good, but how did you know that you were moving your job round in a true circle?"

"Oh, I forgot to mention that the boss had the surplus metal turned off in the lathe, and had a piece of flat iron bent at right angles bolted against the angle plate for the gear to rest on. I thought I did that job pretty slick but the next job, oh, boy!"

"What happened to the next job?"

"Well there is no use mincing matters, I completely spoiled it, and I don't hardly know yet how I did it."

'That sounds interesting. What kind of a job was it?"

"It was a cast iron block. I had to put a 60 deg. dovetail on each side, and make it to fit a female gauge. This was the first dovetail that I had ever done. The first thing I did was to put the head of the shaper round until the 60 deg. mark coincided with the zero, then I tried to cut the dovetail but I found the tool rubbing hard on the back stroke and when I tried the 60 deg. thread gauge on it it wouldn't fit within a mile. I moved the head to a different angle, and by the time I made the work fit the gauge, I had it too small. I must confess I was completely up a tree, and now the job is resting on the scrap pile waiting for a cheap trip to the cupola. What was the trouble, dad?"

"The first difficulty, my boy, was in misunderstanding the graduations on your machine. The machine was at zero when your cross and vertical slides were at right angles to each other. Nearly every shaper and planer that I have seen is marked this way. It is apt to be very confusing to a beginner, consequently when you wanted an angle of 60 deg. with the horizontal, you had to move your head 30 deg. because you were already set at 90 deg.

"Your graduation would now read 30 deg. which does not mean that you would cut a 30 deg. angle, but that you have moved your head 30 deg. from the vertical, which would be 60 deg. from the horizontal. It doesn't follow that after your machine is set to the correct angle that you are going to cut that angle. It is quite possible to cut a right angle and have your machine set for a 60 deg. angle."

"How do you make that out?"

"The shape of your tool has a good deal to do with it. Suppose you had your shaper head set at 60 deg. and the cutting edge of your tool was vertical to your work, you would make a right angle because in that case you couldn't make your tool cut any other than its own shape. In every case of dovetails or undercuts you must be sure that your tool is a smaller angle than the one you desire to cut.

"It will help you to understand angles if you get a common two-foot rule, place one 12-inch length on top of the other and open it out to form a square. Remember that you start at 0 and keep increasing your angle to 90 deg., when your rule will form a square. If you continue in the same direction until you have straightened out your rule you have increased your angle from 90 deg. to 180 deg.

"To avoid the tool dragging on the back stroke, it is necessary to move your clapper box so that your tool will lift away from the work. Before starting a cut always lift up your tool by hand to see that it lifts away from your work. If you were cutting a slot for the head of a bolt you would not be able to move your clapper box. You would have the choice of two alternatives, either lengthen your stroke so that your tool could be run clear through the slot and lifted up at one end and put down at the other, or the tool and clapper box could be fastened rigidly so that they could not move at all.

"I once saw a fellow with an ingenious device for this kind of work. He had a common door hinge clamped to the back of the tool in such a way that it would bend on the forward stroke and when the tool got past the end of the slot it would fall down and on the return stroke lift the tool clear of the slot."

"Thanks, very much, for your explanation, dad. I see the idea clearly, no wonder I spoiled the job."

A short time after John had this conversation with his father, he was promoted to the planing machine, and as the shaper and planer are so near akin we will omit any further reference to the shaper and follow him to the planer.

When he was running the shaper he had often looked with envious eyes at the planer hand riding on the end of the table with his legs dangling down. Now that John is running the planer he is keen to do the same thing himself the first chance he gets.

It so happened that the first job he had was one with a fairly long stroke. John perched himself up on the end of the table and started to kid the other fellows and do all in his power to make them jealous of his soft snap as he termed it, but unfortunately for John the dog on the side of the table which operates the reverse slipped, and before John could grab the wrench and tighten it up, the table had run off the rack to the delight of those around. John naturally came in for some chaffing, and he had hard work to organize a crow bar gang to put the table back in its place, which he was anxious to do before the boss came around.

He was planing a surface plate, and he had received instructions to just rough it out, then take it off the machine, put it on one side, and go on with something else. He didn't understand why he was not to finish it when he had it set up, so he decided he would ask the boss the reason. So when Mr. Smith came around, John, pointing to the casting, asked him why he had had that casting taken off the machine before it was finished.

Mr. Smith replied: "It is like this, John. Cast iron is subject to more or less change of shape, particularly after the outer surface, or skin, has been removed, by turning or planing. One method of avoiding these changes in the finished part is to allow the castings to "season" or stand for several weeks or even months after taking the roughing cuts, before finishing them. These changes are caused by the internal stresses in the casting, which are

gradually readjusted and neutralized by seasoning.

"Sometimes in order to avoid a long seasoning period, castings that must retain their shape as much as possible are subjected to some kind of heat treatment. A method which has proved successful, as applied to the cast iron beds of measuring machines, is in the nature of an annealing process. After rough machining castings, they are placed in a furnace and heated to a dull red heat and allowed to cool very gradually, then machine finished and scraped.

"Another peculiar feature of cast iron parts which are subject to repeated heating and cooling is that they grow or increase in size. This growth is so pronounced that annealing ovens eight feet in length have been known to grow to eight feet six inches."

"There is another very important thing I want to call your attention to. Few machinists realize how easily a casting, even of very large size, can be sprung by careless bolting down to the table. Before finishing a casting that needs to be machined very accurately, it should be roughed all over as there is a certain amount of internal stress in every casting, and any uneven places at the bottom should be packed up, so as to give a good solid bearing surface before being finally bolted down. Otherwise the work will be bolted down, and when the bolts are released it will go back to its original shape, with the result that the planed surface will not be true.

"Where there is a large surface to be machined, like the surface plate you have just taken off, it could have been roughed out with a gang tool holder. Tool holders are commonly used in most planer and shaper work. They are an advantage, not only from the great saving in tool steel, but from the facility with which the small inserted tool can be removed and ground up to shape. One special form of tool holder, peculiar to planers, is for holding three or four inserted roughing tools. These are called gang tools. It has been found that the resistance of a cut varies as the square of the thickness of the chip, and that a rougher feed can be taken if the cut is divided up among three or four tools than would be possible if only one tool was used.

"Cast iron should be finished with a broad flat tool unless the metal is very hard and causes chattering, when the breadth of the tool will have to be somewhat modified. In roughing out cast iron it is sometimes advisable to take a cut with a chisel along the edge, where the tool leaves the work, to prevent it breaking away and leaving ragged edge, but, look, it is 11 o'clock, and time for bed, so off you go, we will continue this discussion later."

Optical Reflecting Power of Nickel and Monel Metal

SOME recent tests of the U.S. Bureau of Standards are of interest in connection with the use of nickel and Monel metal for the construction of mirrors and of reflectors for automobile and locomotive headlights, for searchlights and other similar equipment. The tests show that polished surfaces of both metals reflect a high percentage of light, and greater than most other metals as is indicated in the following table containing the results of reflectivity tests.

Metal	Authority	Per Cent. of White Light Reflected
Nickel	Bureau of Standards	65
Monel Metal	Bureau of Standards	62
Silver	Smithsonian Physical Tables	92
Gold	Smithsonian Physical Tables	65
Speculum Metal	Smithsonian Physical Tables	62
Platinum	Smithsonian Physical Tables	61
Steel	Smithsonian Physical Tables	55
Copper	Smithsonian Physical Tables	55
Nickel Bronze	Rubens and Hagen	49
Tungsten	Coblenz	50

Due to the fact also that nickel and Monel metal are not corrodible metals a polished surface of either will retain its polish and reflecting power and will not become dulled and less efficient upon exposure to air and moisture as surfaces of other metals will.

These valuable properties of nickel are most commonly utilized at present in the form of nickel-plated reflectors and it is in this form that most people are familiar with them. Much interest is being manifested, however, in solid nickel and Monel metal reflector construction, i.e., in reflectors constructed of formed nickel or Monel metal.

Optical Emissivity of Nickel and of Monel Metal

In order to determine the temperature of an incandescent mass of any metal in the open with an optical pyrometer such as that of the Leeds and Northrup Company, or the Scimatco, it is necessary to know the radiating or light emitting power of the metal; namely, the emissivity or the ratio of the light emitted by the metal to that emitted by a perfect black body at the same temperature. The metal always appears cooler or darker than a black body, such as carbon or graphite, at the same temperature for it emits or radiates less light; its emissivity is always only a fractional part of that of the former and always less than one.

In consequence of its lesser light-emitting power the temperature of the metal, when measured optically, appears to be less than it really is and the difference between the true and the "apparent" temperature is greater the smaller is the emissivity of the metal. This true temperature may, however, be calculated from the apparent or measured temperature by using the following equation:

$$\frac{\frac{1}{\text{true temperature} + 459}}{\frac{1}{\text{apparent temperature} + 459}} = .0000579 \log E$$

where E is the emissivity and the temperature are in Fahrenheit degrees.

Tests at the U.S. Bureau of Standards have shown that the emissivity of both nickel and Monel metal in the molten states is .38 and consequently almost equal to that of iron or steel. In the solid state both nickel and Monel become covered with a thin layer of oxide when heated in air to incandescent temperatures; the emissivity of solid oxides of nickel and Monel are .89 and .70 respectively.

REGO CUTTING APPARATUS

We have received a very fine catalogue dealing with Rego welding and cutting apparatus. The Carter Welding Co., Toronto, Canada, are sole sales representatives for this line, and to those not familiar with this apparatus we suggest a perusal of the following:

The Rego principle of gas mixture, whereby the acetylene enters the mixing chamber at a slightly higher pressure than the oxygen, is said to positively insure the elimination of the flashback under all operating conditions. It is claimed that it materially reduces the oxygen pressure, thereby preventing any excess and wasteful oxygen, which is detrimental to good welding. Economy of operation, safety and perfection of flame, are other features claimed for this line.

The catalogue shows some actual photographs of tests for flashbacks, and it is clearly shown that there no flashback occurs. The book deals with the carrying-cases, trucks and various welding apparatus. There are also shown some welding and battery outfits, some lead burning and light welding apparatus, and a decarbonizing outfit.

Another item is a description of the Rego torch, with complete data on the same. The various models are shown, and specifications given. The latter part of the book describes tripod manifolds, wall manifolds, and the Rego diaphragm regulator, together with detailed description. Other styles of regulator are shown, also adapters, hose connections, wrenches, etc., etc.

Calculating Dimensions on 100-h.p. H.R.T. Boiler

The Shell and Joint Portions Are Discussed in This Present Article, and in Later Issues We Will Go Still Further Into This Matter—It is a Good Thing to Know the Whys and Wherefores of Boiler Design.

By T. H. FENNER, Editor Power House

IN our October 14th issue we published an article by the above author dealing with the design of joints of the butt strap type. Believing that readers are interested in these calculations, we continue in the present article to discuss the application of the previous joints discussed to the design of an actual boiler.

Assuming that the boiler is of 100 h.p., the leading dimensions being 72-in. diameter, by 18-ft. long, and a working pressure of 125 lbs. per square inch, we have the following:

The first thing necessary to find is the thickness of plate to carry the required pressure, and this is accomplished as follows: It is a well known fact that the bursting pressure of a sphere is found from the formulae below.

$$f=\frac{pd}{2t}$$

When we wish to apply this to an actual boiler, we have some variations to introduce, these being the least percentages of longitudinal joint, and the factor of safety. Neglecting these for a moment, we will show how to find any one of the factors from the others. For instance, to find the pressure the formula would be

$$p=\frac{f2t}{d}$$

To find the thickness we would have

$$t=\frac{pd}{2f}$$

While to find diameter the formula becomes

$$d=\frac{2tf}{p}$$

The formula to find the working pressure of a boiler is

$$WP=\frac{S\times\%\times 2t}{d\times F}$$

where S = tensile strength of material, % = least percentage of longitudinal joints, t = thickness of plate in inches, d = diameter in inches, and F = factor of safety.

We have already set the required working pressure, and as we are to get a boiler of good workmanship and material we can assume 4.5 as a factor of safety. We will use a triple-riveted double-strap butt joint with an efficiency of 86% for the longitudinal seams, so that all that remains is to find the required thickness of shell. We must, therefore, substitute the known figures in the formula, and thus find the unknown. We have then

WP = 125,
d = 72,
S = 60000,
F = 4.5,
% = 86.

Putting in the figures, we get

$$\frac{60000\times.86\times 2t}{72\times 4.5}=125.$$

It is easier to use all fractions instead of decimals, so

$$\frac{60000\times 86\times 2t\times 2}{72\times 100\times 9}=125.$$

By cancelling out we get

$$\frac{50\times 86\times 2t}{3\times 9}=125$$

$$2t=\frac{125\times 27}{50\times 86}$$

$$t=\frac{125\times 27}{100\times 86}$$

$$t=.3924.$$

The nearest fraction to this is 25-64, but as the plates are not made in variations closer than 1-32, we will call it 3-8 inch and see if that will give the desired result. If not, we will increase it 1-16.

Then

$$\frac{60000\times 86\times 2\times 3}{72\times 100\times 9\times 4}=WP.$$

Cancelling

$$\frac{50\times 86}{9\times 4}=119.$$

This gives only 119 lbs., so we must take 7-16 as the size of plate, and try again.

$$\frac{60000\times 86\times 2\times 7}{72\times 100\times 9\times 8}=WP.$$

Cancelling

$$\frac{25\times 43\times 7}{6\times 9}=139.$$

This gives us 14 lbs. more than we require, but as plates in this country are not rolled to dimensions of thirty-seconds of an inch, we must use the 7-16 plate. This is a good fault, as it allows a margin against corrosion, and makes practically no difference to the heat conductivity. It also allows a bigger factor of safety. This will now be, assuming the pressure is carried at the figure first set

$$\frac{60000\times 86\times 7}{72\times 100\times F\times 8}=125.$$

Then

$$F=\frac{60000\times 86\times 7}{125\times 72\times 100\times 8}$$

Cancelling

$$F=\frac{86\times 7}{5\times 24}$$

$$F=5.$$

Designing the Joint

We have now got the diameter, length and thickness of plate of the boiler, and now we will determine the particulars of the joint.

First, as we have seen in the articles on riveted joints, we will determine the pitch of rivets in the outer row. Then

$$\frac{P-D}{P}=.86$$

$$P-D=.86P$$

$$D=.14P.$$

Now we have 7-16 plate, we will have a 15-16 inch rivet, and if the diameter is .14 of the pitch, the pitch will be

$$\frac{.9375}{.14}=6.69 \text{ or say } 6\ 11\text{-}16.$$

Let us see how close this will come to the required percentage.

$$\frac{6.6875-.9375}{6.6875}=85.98\%.$$

This is sufficiently close for all purposes. We will now try the rivet strength, using the pitch found. We

shall have four rivets in double shear and one in single shear, making eight rivet areas in all. Then by formula, using .7 as the constant for steel rivets in steel plates

$$\frac{a \times n \times C}{p \times t} = \%.$$

Then

$$\frac{15 \times 15 \times .7854 \times 8 \times 70 \times 16 \times 16}{16 \times 16 \times 107 \times 7 \times 100} = \%.$$

Cancelling

$$\frac{9 \times .7854 \times 20}{107} = 132\%.$$

This gives a much higher percentage of rivet strength than plate strength. By reducing the rivet diameter to ⅞ inch we get a higher plate strength, and a lower rivet strength, thus

$$\frac{7 \times 7 \times .7854 \times 8 \times 70 \times 16 \times 16}{8 \times 8 \times 107 \times 7 \times 100} = 111.3\% \text{ rivets}$$

and $\dfrac{6\ 11\text{-}16 - ⅞}{6\ 11\text{-}16} = 86.9\%$ for plate.

This is more in proportion, and the smaller size rivets will reduce the cost of manufacture.

We will now see if we are within the limits of the maximum pitch as allowed by the Ontario regulations. The maximum pitch is found by using the formula

$$PM = (C \times T) + 1⅝$$

where PM = maximum pitch,
C = Constant,
T = Thickness of plate in inches.

The constant C varies with the type of joint as follows:

No. of Rivets in one pitch	Constant for Lap joint	Constant for Double butt Strap joints
1	1.31	1.75
2	2.62	3.5
3	3.47	4.63
4	4.14	5.52
5	....	6.00

As there are five rivets in a pitch, we must use the constant 6. Then

$$PM = (6 \times .4375) + 1.625$$
$$= 2.6250 + 1.625$$
$$= 4.25.$$

Although the regulations omit to state this, in a joint with every alternative rivet omitted in the outside row, this formula should be multiplied by 2, and in this case the maximum pitch for the outside rivets is therefore 8¼ inches, and we are well inside this dimension. The combined efficiency of plate and rivets must be found from the formula given in the regulations:

$$\frac{(A \times C) + (P - 2d)T}{P \times T}$$

This, as can be readily seen, is the shearing strength of one rivet, multiplied by the constant, and added to the net section of the plate between the outside row of rivets, divided by the unit section. Substituting figures we get

$$\frac{\left[\frac{7 \times 7 \times .7854 \times 70}{8 \times 8 \times 100}\right] + \left[6 - 1¾\right] \times \frac{7}{16}}{6 \times \frac{11}{16} \times \frac{7}{16}} =$$

Combined Efficiency.

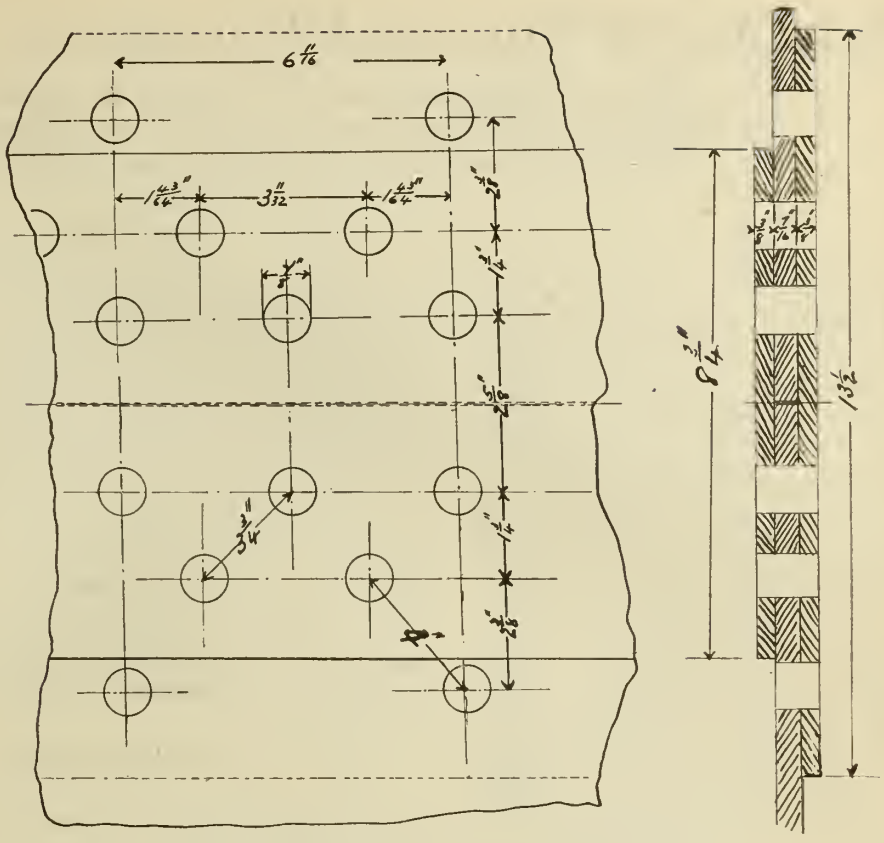
Reducing to decimals it becomes

$$\frac{.42 + 2.16}{2.92} = \frac{2.58}{2.92}$$

$$= 88.3\%,$$

which is higher than the plate strength as determined.

We must now determine the distance between the rows of rivets, and the exact allowable arc definitely decided by the regulations. Of course one could arrive at this distance by calculating the section of metal to be left to secure the necessary strength, but for the purpose of those passing examinations it will be better to work out the formulae set down by the Ontario board. The minimum distance between the outer and middle rows is found by the following expression, where V = the minimum distance:



TREBLE RIVETED DOUBLE UNEQUAL STRAP JOINT.

$$V = \sqrt{[(11\text{-}20P + d)(1\text{-}20P + d)]}$$

In order to make these clear we will show the various steps in full. Substituting figures we get

$$V = \sqrt{[(11\text{-}20 \times 6.6875 + .875)(1\text{-}20 \times 6.6875 + .875)]}$$
$$= \sqrt{[(.55 \times 6.6875 + .875)(.05 \times 6.6875 + .875)]}$$
$$= \sqrt{[(3.6781 + .875)(.3343 + .875)]}$$
$$= \sqrt{(4.5531 \times 1.2093)}$$
$$= \sqrt{5.4793}$$
$$= 2.33$$

Therefore 2.33 inches is the minimum distance between outer and middle rows. For the distance between inner and middle rows we have

$$\sqrt{[(11P + 8d)(P + 8d)]} \div 20$$

Substituting figures

$$\sqrt{[(11 \times 6.6875 + 8 \times .875)(6.6875 + 8 \times .875)]} \div 20$$
$$= \sqrt{[(73.5625 + 7)(6.6875 + 7)]} \div 20$$
$$= \sqrt{[80.5625 \times 13.6875 \div 20]}$$
$$= \sqrt{[1102.69 \div 20]}$$
$$= 33.2 \div 20 = 1.66.$$

Then 1.66 inches is the minimum pitch between the inner and middle row.

For the minimum diagonal pitch between inner and middle rows the formula is

$$P = (3P + 4d) \div 10$$
$$= (3 \times 6.6875 + 4 \times .875) \div 10$$
$$= (20.0625 + 3.5) \div 10$$
$$= 23.5625 \div 10 = 2.35.$$

(Continued on page 68)

Relation of Fuel and Furnace to Heat Treatment

Technical Appellations Are Avoided as Much as Possible—Principal Fuels Used Are Discussed, Also Furnaces and Burner Nozzles—This Article Should Be Read by All Interested in Heat Treatment.

By R. P. MAYNARD *

IN dealing with this subject it is not the purpose of the writer to avoid in so far as is possible any technical appellations, and to refrain, moreover, from reference to any commercially advertised appliances, such as furnaces and burners of which there are legion. My vocation brings me in intimate touch with the heat treatment of steel in all its many phases and in shops utilizing appliances from the most modern to the crudest makeshift. In the course of this constant contact with the steel treater, I find that he is invariably well trained in the handling of both high and low carbon steel, and possesses almost infallible knowledge of the requisite textures, grain and lustre of the metal in all its varying degrees of carbon content, and that, while he is aware that heating is the most important of all the operations to which steel must be subjected, still I find that in the majority of cases he is grossly ignorant of that which makes the heat possible—namely, fuel application.

Besides the steel, there are three other prime elements involved in its treatment, which are (1) furnace; (2) fuel, and (3) operator. The latter is often like the average automobilist, whose knowledge of his car extends only to the hood and footboard. It is my intention to convey henceforth a brief discussion of combustion and its application, augmented by a few criticisms of what is hoped will be of a constructive nature.

The principal fuels used in heat treating are bituminous and anthracite coals, coke, fuel oil, natural gas and gas manufactured from solid or liquid fuels. These fuels consist of combinations of carbon, hydrocarbon and hydrogen, which, when combined with oxygen at certain temperatures, unite and form a combustible mixture. The source of oxygen is, of course, the air, and the more intimately it is mixed with a given fuel, the more efficient the combustion derived.

Fuels Used

Solid fuels are gradually being displaced for heat treating by liquid and gaseous fuels, with the latter, gas, predominating, principally because of its cleanliness and convenience. Of all the available fuels used commercially, gas is the only one which the steel treater does not have to handle, store and distribute, and is, moreover, unique in that it is not paid for until after being used.

Most gas companies maintain a corps of trained industrial fuel engineers, whose business it is to assist the steel treater in his heating problems, and it is partly because the oil companies do not offer this engineering service that this splendid fuel is not in more general use for the heat treatment of steel. Properly burned, the use of oil affords a marked economy, especially when used in connection with the larger furnaces, for in the use of oil the heat treater is simply operating miniature gas plants, as the liquid hydro-carbons are expanded into a gas and united with oxygen to produce heat. To burn a given quantity of oil requires the same amount of air as is required to burn the equivalent heat value of gas. The luminosity of the flame is due to the carbon content of the fuel, which insures a soft reducing furnace atmosphere, thus eliminating the possibility of scale.

Must be Thoroughly Screened

To properly burn a liquid fuel requires that the oil be thoroughly screened, as no oil burning system can burn oil that is not clean. The liquid must then be as finely divided as possible, and while in this atomized state must be mingled with the proper amount of air to support combustion. The liquid hydro-carbons can be finely divided by several methods. Air at a high pressure may be made to travel at cross-current with the oil stream, and the oil caused to spray by the impact of the compressed air. Steam may also be used in the same manner, with the added advantage that it imparts a certain amount of hydrogen gas which unites with the oil. However, latter day practice is treading away from compressed air, and the prevailing custom shows that the average shop is using air at only six to 12 oz. pressure with oil at from 20 to 50 lbs., and with gas at from two to four oz.

One of the principal sources of grief which the heat treater has to contend with is the blower problem. The two prevailing methods are the central air installation which embraces the distribution of air through pipe lines, and the unit blower application, where a small fan is connected to each furnace. Both processes have their advantages, but it has been conclusively proven that no fuel burning equipment has as low power factor as the small unit blower, which enables not only individual control, simplicity and quietness of operation, but which has frequently saved its first cost from the difference, as against the central system, in operating power during a reasonably short period. No matter how small any installation of a central system, where additional equipment is at all probable, the subsequent additions to furnaces usually exceed the original provision for air, whereas the unit system easily provides for this.

Just a word about furnaces and burner nozzles. There are more than a dozen large builders of reliable heat treating furnaces in the United States, and their products are, in the main, uniform. While many of these manufacturers have made progressive strides in furnace design and construction, still there appears to be in most furnaces—especially in the semi-muffle type—a conservative standardization. Whether this is due to lack of imaginative ingenuity, or simply a frank admission that the present type of furnace has reached its perfection, I do not pretend to advance. From time to time a builder will improve a door lifting device, or add sturdier legs, or heavier refractory linings, but I will venture to predict that the coming year will see some radical departures in furnace construction.

Already I notice a tendency to decrease the number of burner nozzles on heat treating furnaces. It has ever been the theory of the furnace builder that inasmuch as heat must be applied with uniformity and not in spots only; numerous burner tips must be located along the side of the furnace. May I not draw a comparison that the days of the bucket brigade are over, and that with two healthy streams of water a modern fire department can do more than with 1,000 water buckets? Any furnace fired with 20 nozzles can be heated just as efficiently with two, or at most, with four, when properly spaced and of adequate capacity. It is like comparing 20 little water falls to the concentrated power of Niagara.

Let me also advise against the use of the "pepper-box" or "honeycomb" type of nozzle now in general use. These nozzles can easily withstand high temperatures in a large combustion box, but are apt to fuse and oxidize in a small furnace. They should never be used in a high speed furnace. Also I find that in most furnaces the nozzle tips are set well back in the channel port of the refractory lining, and if the nozzle tip is of the pepper-box variety, the restricted channel only shortens its usefulness. My experience has convinced me that a nozzle should be of a single orifice, set flush with the inside wall of the furnace lining and cemented in so that no metal is exposed to the heat.

A thing of paramount importance in heat treating is the furnace atmosphere, which is influenced directly by the proportions of fuel and air, as well as the intimacy of their mixture. The result of incorrect proportions of fuel and air and imperfect mixture thereof is often the cause of injury to the steel, and will even cause carbonizing boxes to scale ex-

*From Journal of Steel Treaters' Society.

cessively and become prematurely useless.

Furnace atmosphere also has its bearing on the heating of high-speed steel. In shops where the high-speed furnaces are kept constantly at a working temperature, there is little chance of damaging the most delicate high speed steel. But in the hardening room, where a high-speed furnace is used intermittently there is danger because the operator will employ a highly oxidizing blast to bring a cold furnace up to heat quickly, and then neglect to change the character of the flame when entering the steel.

This calls to mind an incident which happened recently, which might well be called the "Parable of the Small Gas Meter." A steel treater had a carbonizing oven and cyanide furnace, the combined gas consumption of both taxing the capacity of the single gas meter, but he was not aware of it. He later installed a high speed furnace, and in making the burner installation of this appliance I suggested that he had better notify the gas company to install a larger meter. Evidently he thought a larger meter would register more gas in proportion than the present meter, thus increasing his unit fuel consumption on his present basis of production. At any rate, the small meter remained, and when all three furnaces were in operation he could not keep from "pitting" the high speed steel because of insufficient gas and excess air. The moral of this is that if you use gas in your heat treating room, always consult the gas company in making changes or additions to your equipment. They are genuinely anxious to sell you service—not merely fuel.

Another thing, never use a furnace that is too big for the work required. It is poor economy. I know of a shop in Chicago where they bought a big semi-muffle furnace, which plays as many roles as the bass-drummer in an "Uncle Tom's Cabin" troupe. They use it for forging, annealing and case hardening, and I might also add that in the latter practice this same firm also seal their carbonized boxes with Portland cement instead of fire-clay.

There are constantly little occurrences in the hardening room which are perplexing, especially to the inexperienced steel treater. I have often heard a heat treater assail the gas company for poor gas service, when all in the world the matter was that the salt mixture in his potassium chloride (clean heat) bath was ready for the embalmer, or else perhaps he was quenching his steel in oil or water which was far too hot. On the other hand, I have seen the heat treater blamed when gears which he had hardened and sent on into another department had subsequently been ground with the wrong sort of abrasive wheel.

The Question is "Will It Work?

A Claim That the Introduction of Chemical and Metallurgical Science Has Not Proved to Be a Panacea for All Industrial Evils.

By HENRY TRAPHAGEN

THE introduction of chemical and metallurgical science in our industries has not proved to be the panacea for all industrial evils that the layman imagined it to be. Profound scientific learning or skill in chemical technique will not always solve our industrial problems. After all is said and done, it appears to me that the one big outstanding dominant question in the industries must be, "Will it work?"

Is the material suitable for the purpose for which it is sold. Is the material capable of weathering abuse in unskilled hands? Is the material sound; is it uniform; is it the finished product of skilful craftsmanship or a flimsy makeshift designed to meet an arbitrary formula? These are some of the questions that the conscientious manufacturer must ask himself if he would know the real worth of his product.

The consumer is little concerned with how a product is made; it is of little moment to him what the manufacturer puts into the material. But he is vastly interested in how much service he can get out of it. Again, it is the same old question: "Will it work?"

It requires more than a knowledge of metallurgy to run a steel mill. The most expert chemist on earth cannot make a good drill if he is not a mechanic, nor can he devise tests that will show up the practical defects in such a drill if he is not acquainted with the mechanical details of such tools. The most carefully computed mixture that ever graced a charge slip will not make a good heat if the cupola tender does not know how to patch his lining or if the chemist does not know how to recognize physically defective coke. All the chemical analyses in Christendom will not make a porous casting sound. The best ingot that was ever poured will not produce a trustworthy rail if the roller tears and pinches the billet in rolling, and so it goes. No product is any better than its weakest point. There is that ever present chain of operations, each link separate, yet indissolubly joined with the other. If one link is faulty the chain is useless. Truly no product is any better than the man who makes it. And this is doubly true in the various metal industries.

Science is Wonderful

Metallurgical science is a wonderful thing. Wizards of the past and present are the creditors of the world, for the debt can never be fully paid. Still it must be remembered that metallurgy and chemistry are not cure-alls. The scientist cannot make a workman out of an idiot; nor can he evolve that mystic formula that can wipe out and supersede craftsmanship.

Things of metal have always been and always will be products of personal skill and experience. It would be well for us to pause, think, and think deeply and earnestly, before we embrace any mechanical contraption that purports to be a substitute for human intelligence. The light of science has shown the way through dark and devious paths. The flaming torch of the pioneer has given way to the searchlight of organized science. Yet that all-powerful light is in imminent danger amid the disconcerted flashes of a million lesser ill-directed lights.

Weeds grow thicker and faster than flowers. The broad-minded, practical, experienced scientist is one thing. The arbitrary, shallow, inexperienced chief chemist or metallurgist, found in many plants, is quite another. How often do we see perfectly good steel rejected because the phosphorus content may be one thousandth of one per cent. above an arbitrary limit. And on the other hand, how often do we witness the curious procedure of accepting a carload of defective castings on the evidence of a doctored and carefully nursed test-bar.

Producer Must Analyze

The chemist and metallurgist in the plant of a large producer functions in quite a different manner than the fellow in the shop of a consumer. The producer must analyze in order that the product may be sorted. He must attempt to cater to the wants of many and varied customers. Hence, the number of laboratories that are to be found in our large producing mills. Keep in mind that a chemical analysis is a sorting process and nothing else. It is no guarantee of workmanship, it is no protection against physical defects, and the fact that metal may be of proper composition will not prevent a sloppy, ignorant workman from ruining good material.

The gentleman who buys must have a laboratory. He must imitate the big fellow. He must analyze a package of drillings from every shipment; he must copy impossible specifications from handbooks and force them upon the producer. He must rave about accuracy in composition, and at the same time let the question of workmanship go to pot. He sees fit to allow a youngster fresh from college who cannot drive a nail with six hammers dictate to the producer, whose product is backed up by years of experience.

Now what has been the result of all this? Naturally, the customer must be pleased. The producers have carefully

Continued on page 69



WHAT OUR READERS THINK AND DO



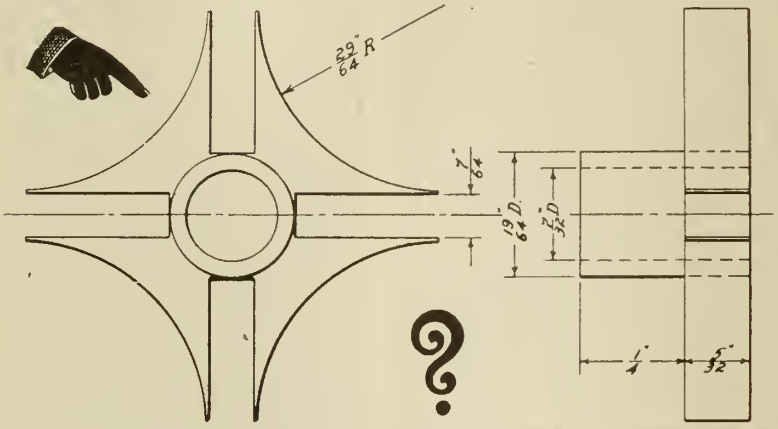
HERE'S A PROBLEM

Small jobbing shops frequently are called upon to do work that taxes the ingenuity of the man in charge, and when small quantities of certain pieces are required to be produced, the time allowed does not permit of expensive jigs and fixtures by which the work could be carried out successfully. On the other hand the piece may be so intricate or necessitate such close accuracy that great care must be exercised in deciding on the process of manufacture so as to avoid loss through the possibility of errors arising from the method adopted.

Such a job is shown in the accompanying sketch. These pieces represent a Geneva movement that forms part of the mechanism for moving picture machines. Unless the different sections of this piece are absolutely uniform and to dimensions they are not suitable for the duty they are required to perform. A short time ago a small shop in Montreal secured a trial order for about one hundred of these, with the prospect of obtaining a considerably larger order if the work proved satisfactory. The trial quantity was completed, but quite a number of pieces failed to pass the customer's inspection. At present the superintendent of the shop is devising other methods of doing the work, and he is desirous of learning of ways and means from some of the readers of Canadian Machinery as to the best method of accomplishing the job.

The piece is made of cold rolled steel and the dimensions and uniformity must be very accurate. Production would approximate 5,000 yearly.

Readers are requested to send in their ideas as to the best way of manufacturing this Geneva movement, and an estimate of the cost of production per 100. We shall, of course, pay for all acceptable material as usual.

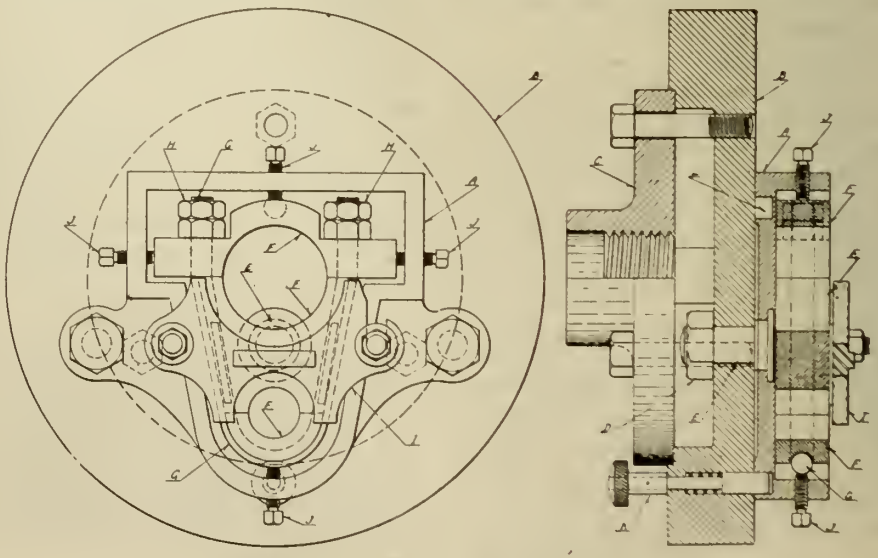


BE SURE AND SEND IN YOUR IDEAS ON THIS PROBLEM. WE WANT THEM.

BORING JIG FOR THREE-PIECE BRASSES

By J. H. Houldsworth

The accompanying drawing illustrates the assembly of a box jig used for boring out the two holes in the three-piece brasses for the cutter levers of the tiffin nail machines. This is a marked improvement over the old method of holding the brasses in a chuck, as it insures greater accuracy, both in centre distance and alignment of the holes. In the fixture shown the jig A is secured to the special face plate B by a bolt on either side, and midway in the centre line of these bolts is the swivel bolt E, held in position by the nut D. Ample space is provided for operating the nut by fitting the auxiliary face plate with four bearing lugs. The jig face plate is secured to the lathe face plate by three equally spaced bolts. The three brasses F. F. F have semi-circular grooves on the sides, and are firmly bolted together by means of the round strap bolt G and the nuts H, H. The swinging clamp 1 is provided with two small strips for clamping the brasses in the fixture. The four screws J are used to line up the brasses before boring. The swivel bolt E is located the same distance from the centre of the two holes, so that when one is bored the clamping bolts are removed and the stop pin K drawn back, to permit of turning the fixture through 180 degrees, when the stop pin engages with the small hole L, thus bringing the small hole in the correct position for boring. When these brasses are worked in quantities this jig is highly efficient and economical.



ASSEMBLED VIEW OF THE BORING JIG.

Want Locomotive.—The Department of Railways and Canals, Ottawa, is asking for tenders on a new or second hand switching locomotive: One (1) only 0-4-0 switching engine, 50 or 60 tons, saddle tank type preferred, but would accept engine with tender if former not obtainable. Quote price for delivery at Government siding, Merritton, Ont., freight, duty and all other charges paid.

MAKING EFFICIENT BEVELS

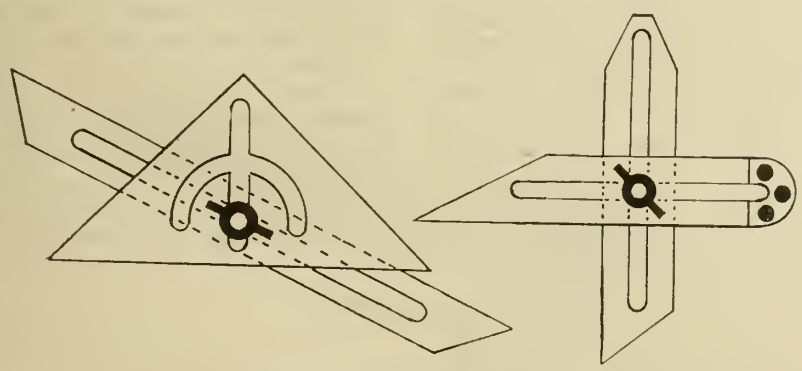
By W. S. Standiford

ONE of the most important tools in frequent use by machinists and other metal workers for testing the accuracy of angle work as it progresses is the bevel gauge. This instrument, as bought in the hardware stores, has two drawbacks which are as follows: The blade is made too wide so that when a machinist, etc., has to measure an angle on the edge of a narrow slot which he is turning in a lathe, the tool is altogether useless, as it cannot be used at all in such a case. Where a very shallow slot, having sufficient width to allow insertion of bevel gauge blade, is being turned, it will be found that the end of the opening slot in blade does not allow the tightening screw to approach the blade point, which is essential in order to measure angles on shallow depth work.

Most bevel gauges have the end of slot placed about 1½ inches distant from the blade's extreme point, thus preventing the use of the tool for narrow slots and shallow slot work. Of course, the end of the hole can be filed down toward the point and the blade ground down to narrow dimensions on an emery wheel so that it could be used, which was done by the writer and enabled him to finish a piece of emergency work on a breakdown job on which, as is usual in cases requiring rapidity of action, not much time can be lost; the gauge thus ground down did not last many years as the blade, having been made out of too soft a steel, wore out rapidly. Since then, the writer has made the gauge depicted in Fig. 1 out of high carbon steel, and it still shows no appreciable wear.

To make one like it proceed as follows: Get from a hardware store a small threaded square shouldered bolt of sufficient length to suit thicknesses of steel for blades, and ⅛ or 5-32-inch diameter. If a bolt with a square shoulder is unobtainable, it will either be necessary to make one or else rivet a piece of steel placed lengthwise on one piece so as to prevent the bolt from turning when the wing-nut is tightened up. Select a bolt with a wing-nut on it instead of one having a round thumb screw, as the former allows of greater tightening pressure.

If a bolt of ⅛ or 5-32-inch is not procurable, send away to any model maker's supply house. It is essential to use as thin a bolt as possible in order to make use of as narrow a blade as is practicable, which allows of working in small slots. Bevel gauges can be made any desired size, but the one illustrated is just the right length in ease of handling and for general all-round work. Make the slotted blade out of ⅛-inch thick steel, the slot to be made first and of sufficient width so as to let the fastening bolt slide easily along it. The blade should be made either ½ or ⅝ inch wide, these sizes making a tool that can be used in various chamfering work and other difficult places where the ordinary article would be entirely useless. Five inches long is a good length to make the movable blade and also the horizontal ones. The latter is to be constructed out of two pieces of ⅛-inch thick steel, both pieces should be made the same size, the width being one inch and having its sides filed, planed or ground to a straight edge. Make a piece of steel of the same thickness as the movable blade, and as wide as the stationary ones. Fasten this piece on one end and between the two blades by rivets. This steel washer allows the movable blade to slide in a slot and also lets it go to one end of the stationary pieces. When the wing-nut is tightened up, the side pieces are sprung together and caused to grip the central angle blade tightly, the result being that it will stay in any position and withstand a fair amount of hard knocks before it alters its setting. In use this type of device proves to be very handy as it can be adjusted for chamfering work on both deep and very narrow slots. The flat edge, or side, on the movable blade makes a very handy depth gauge, thus two tools are combined in one, either of which can be used separately when the other is not set.



FIGS. 1 AND 2—SHOWING TYPES OF GAUGES DESCRIBED IN TEXT.

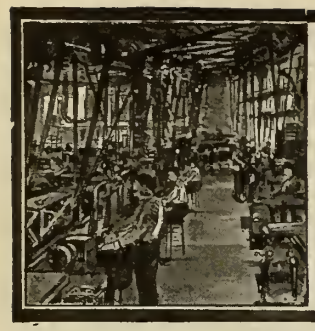
Another novel and very effective form of bevel gauge is shown in Fig. 2. This tool is made out of high carbon tool steel plate annealed; ⅛-inch thickness is a good size. It is cut out in triangular shape, the shoulder on the fastening bolt sliding in the curved slots. When the writer first made this gauge the slots were curved in circular form as shown in the photograph of sketch, but if I ever make another one, the slots will be extended out to the extreme corners of the triangle, as I believe that it would be much better, although experience shows that the tool is very handy as it is. The beam, like the three-cornered piece, is made out of ⅛-inch high carbon steel plate, as this thickness makes a very compact and long wearing tool. No description of it is necessary, as the illustration shows the construction plainly, it only being essential that the edges of the square shouldered holding bolt should be rounded slightly with a file, so as to allow it to slide freely in the curved parts of slot. This gauge is shown with its beam set at an angle to the long side of the triangular section, but as will readily be seen, it can be used with any one of its angles, thus allowing of chamfering work in and around and close to metal shoulders on metal being turned in the lathe or for shaper or planer work. Metal shoulders being in the way generally interfere with the setting and working of the ordinary type of bevel gauge. The sharp point of the triangle will allow it to be set and used in chamfering the edges of a very narrow and shallow slot.

In conclusion, any mechanic who constructs either type of instrument will find them to give good satisfaction on all classes of work, and if they are made out of high carbon steel, long wearing tools will be the result of the construction.

PURIFYING OIL BY CENTRIFUGAL ACTION

For many years there has been in use in most of the large engineering works of this country a centrifugal separating machine which removes the oil from iron and steel turnings or borings, and thus permits it to be used over again. The idea which underlies this machine has now been carried further and applied to the removal of dust and dirt which unavoidably collect in oil used in the lubricating systems of marine and other large engines. The new machine is very similar in form and operates on the same principle as the now well-known centrifugal cream separator. The foul oil is fed continuously into the machine through a strainer which catches any gross particles, precisely as milk is fed into the cream separator. The purified oil escapes continuously, while the dust and dirt collect on the inner surface of the separating drum. Provision is made by which the attendant can instantly tell when the machine is choked with the deposited impurities.

For many years an employee of the Steel & Radiation Co., Limited, Toronto. H. M. Alexander relinquishes his position with the company to become secretary-treasurer of the Toronto Refining & Manufacturing Co. and the Mona Oil Co.



DEVELOPMENTS IN SHOP EQUIPMENT



AUTOMATIC TURRET LATHE

THE illustration depicts a turret lathe recently put out by Alfred Herbert, Ltd., Coventry, England, with offices at 1-3 Jarvis Street, Toronto, Canada. This machine has a maximum swing over the bed of 18½ inches, and is known as the No. 5 model. All operations are automatic, except chucking, and the machine stops automatically at the finishing of a piece. There are a number of interesting features to the lathe, such as the longitudinal adjustment of the headstock, the independent operation of the front and rear cross-slides, and the low position of the spindle, which makes setting up an easier task.

Constant-speed drive by a 4 inch belt is employed, the 10 inch driving pulley running on ball bearings. The drive can be engaged for starting the machine by means of a friction clutch operated by a hand lever. The headstock is adjustable along the bed for a length of 6 inches and its mechanism is completely enclosed, the gears running in oil.

Spindle Speeds

There are five spindle speeds that are changed automatically. It is claimed that the changing is performed instantaneously and silently and that it can take place while the tools are cutting, if necessary. Change gears are provided to give six principal or substantive speeds, by which the range of the automatically-operated speeds is changed. Since these five automatically changed speeds can be used with each substantive speed, a total number of 30 steps is provided in a range from 14 to 411 r.p.m., the maximum gear ratio being 28.5 to 1. If desired, change gears can be furnished to give additional speeds.

The hollow spindle is 5⅛ inches in diameter at the front neck and has a flange on the nose 10 inches in diameter. It has a bore of 3⅝ inches, runs in white metal bearings and is provided with a ball thrust bearing. It can be stopped automatically at any instant and then restarted automatically in time for the next cut. This action is valuable, particularly to enable the withdrawing of a tool at the end of a cut without leaving a helical mark on the work.

The turret has four faces, machined square with the spindle. The tool holes are 2⅛ inchs in diameter. The turret is mounted on a slide having a working stroke of 13 inches. It is indexed at the extreme back position and then clamped automatically.

The cam controlling the action of the turret consists of a drum running in oil and driven directly by a worm. It is provided with two grooves, one for moving the turret slide and the other for indexing the turret. Since the latter action occurs only when the turret is in its extreme back position, all of the working stroke is available for actual machining operations. The turret-actuating groove is cut like a screw-thread and returns upon itself, so that the turret moves with a smooth and steady motion. It is claimed that no irregularity or jumping occurs, even when taking heavy cuts.

For each complete forward and return movement of the turret the cam makes three complete revolutions. Rotation of the turret to present a different tool to the work requires but 1.1 second, and the time for a complete cycle of the machine at high speed is only 48 seconds. The turret is 11¼ inches in diameter, and the centres of the tool holes are 4⅛ inches above the slide. The distance between the face of the turret and the face of the spindle varies from 15 inch as a minimum to 34 inches as a maximum.

Cross-Slides

The front and back cross-slides are independent of each other in their action, and can be set to work either at the same time or separately, as required. For example, roughing and finishing facing cuts can be taken simultaneously. The cross-slide cams can be adjusted to operate at any part of the cycle of operations. Each cross-slide is provided with a double toolholder and a stop with screw adjustment for regulating the diameter turned.

The centre of the spindle is 4½ inches above the top of the front slide and 3½ inches above the back slide. The slides have adjustments along the bed of 7½ inches independently of each other. The horizontal distance from the spindle to cross-slides can be varied from nothing to 11½ inches, power feed being available for a stroke of 4½ inches. The maximum diameter admitted between the cross-slides is 16 inches. Ample room is provided under the tools for the chips to get away, the chute for this purpose being plainly visible in the illustration.

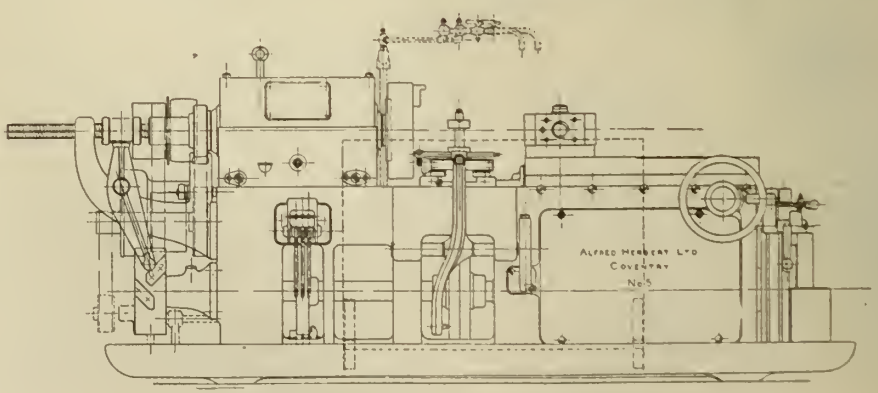
Ranges of Feed

The "self-selecting" feed motion provides for both the turret and the cross-slides, ranges of 7 feeds, any one of which can be brought into action instantly at any part of the cycle, even during a cut, if required. The feeds are driven from the headstocks, but the quick or idle motions are driven from the constant-speed driving pulley, so that the idle motion always takes place at the same rate of speed. It is claimed that the range of feeds is sufficiently broad so that it is never necessary to change the feed cams. The feed of the turret slide varies from 1 to 144 revolutions of the spindle per inch of feed, and that of the cross-slides from 40 to 366 revolutions per inch.

The bed is a box casting. It is built low, the spindle being only 40½ inches above the floor, so that the machine can be tooled up and attended more conveniently. The tray extends the full length of the bed and provides ample room for chips.

A pump with fittings, including splash guards, is supplied at extra cost. Oil supply through the turret can be furnished for use with hollow tools for carrying lubricant to the cutting edges.

A back-facing attachment can be furnished if desired. It is claimed that its



LINE DRAWING OF THE NO. 5 TURRET LATHE.

use often enables a piece to be completely machined at one setting instead of two.

The 15 inch Coventry chuck is suitable for use with this machine, although special chucking fixtures can be furnished for work that cannot be handled by it. A standard tool outfit can be supplied and the maker recommends its use for general work. The outfit includes a centering tool, facing tools for the cross-slides, boring bars and combination boring, turning, and facing tools that are provided with an overhead support.

The machine is intended to be driven by a 7 h.p. motor. The floor space required is 6 x 12 ft., the approximate net weight is 8,500 lbs., and the size when boxed for shipment is 340 cu. ft.

COMBINATION TOOLHOLDER

The toolholder as illustrated has been placed on the market by Maurice H. Derringer, 3133 N. Eighth Street, Philadelphia, Pa. It is intended for medium sized work on lathes from 12-in. to 20-in. swing. On the end shown at the left is a yoke which can be swung to either side of the bar. One side of the bar is adapted for holding square stock up to 5-16-in. and the other side, formed as a V-block, will hold round stock from ⅛ to 9-16 in. in diameter. This groove is useful for holding indicator stems as well as boring or internal-threading tools. When the holder is placed in position in a lathe, the screw in the lathe toolpost can be tightened on the end of the tool, thus holding it rigidly. The yoke may be easily removed by taking out the taper pin which holds it. The other end of the holder is provided with a goose neck which can be locked in position at any angle. This neck will hold 5-16-in. tool stock, being especially adapted to thread cutting.



GENERAL VIEW OF THE HOLDER.

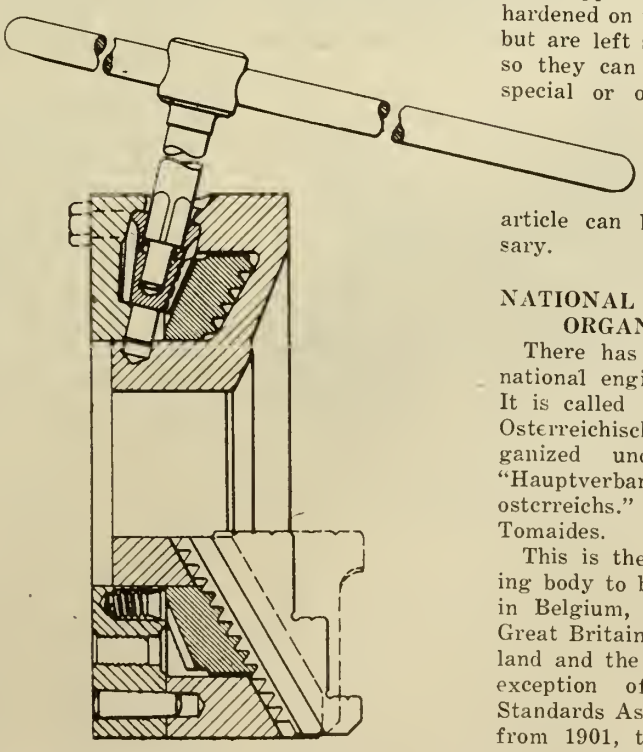
IMPROVED SPIRAL CHUCKS

The Charles Taylor, Limited, of Birmingham, England, have placed on the market their patent improved spiral chucks. These chucks are being handled in Canada by Messrs. Williams & Wilson, 84 Inspector St., Montreal, and they are exclusive agents for the same.

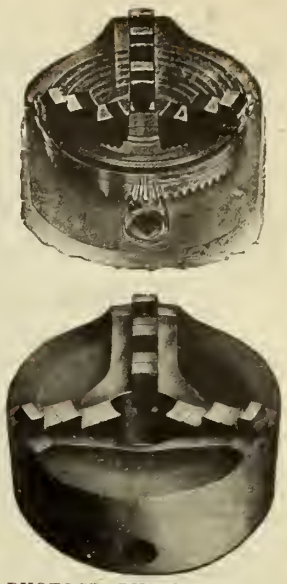
These chucks, of which we show illustrations and line drawings, embody many interesting and important features of design that add greatly to their efficiency and durability under continual and exacting service, and are the recent outcome of 35 years of manufacture and study of self centring chuck requirements.

The construction of the chuck is such that the movement of the jaws is not at right angles to the lathe spindle, but inclines inwards at an angle of about 30 degrees. This design permits of a thrust upon the spiral rack and more directly back of the jaws, thus minimizing the tendency to tilt that is said to be always present in chuck jaws where the movement of the jaws is square with chuck axis. The V shape of the rack permits of a finer pitch, giving greater gripping power and the inclined position provides for a better distribution of the pressure, as the bulk of this is transmitted through the solid metal of the jaws and square with the axial line of the rack.

The pinion for operating the spiral rack is non-projecting and the bearing



LINE DRAWING OF CHUCK.



PHOTOGRAPHS OF CHUCK.

surfaces of all moving parts are hardened and ground. This adds very greatly to the life of the chuck. Special provision is made for taking up any slight wear of the moving parts. Every part of these chucks is made to limit gauges and is interchangeable and every chuck is guaranteed to grip true to within .002 measured 3 inches from face of jaws. They are claimed to be the tightest gripping self-centring chucks made.

The strength of the parts of this improved chuck permits of a length of key handle approximately twice that of ordinary chucks, giving corresponding greater grip and providing this extra grip by leverage that loses nothing in extra friction. In addition to the usual 3-step and bar jaws, "soft" blank jaws are supplied. These blank jaws are hardened on the teeth to withstand wear, but are left soft on front face and grip, so they can be machined to hold any special or odd shaped article. They are of high class case-hardening steel and after machining to hold the special article can be case-hardened, if necessary.

NATIONAL STANDARDIZING BODY ORGANIZED IN AUSTRIA

There has been formed in Austria a national engineering standardizing body. It is called the "Normenausschuss der Osterreichischen Industrie" and is organized under the auspices of the "Hauptverband der Industrie Deutsch-osterreichs." The secretary is Dr. Jaro Tomaides.

This is the tenth national standardizing body to be formed, the others being in Belgium, Canada, France, Germany, Great Britain, Holland, Sweden, Switzerland and the United States. With the exception of the British Engineering Standards Association, whose work dates from 1901, they have all been formed since beginning of the European war.

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Keep Buyers in the Market

PRICE deflation is a matter that many papers do not care to say much about, as it is a question that can cause a great deal of misunderstanding. There are always those willing and ready to read into an article things and ideas that were never intended.

But the question of prices is so tied up with every phase of business that it must be considered. Men are talking about the process, and it is more marked now than it has been for many months. It was expected when the armistice was signed that there would be a rapid drop in prices. In fact many people were looking for a crack right then and there, but it was postponed, and from the way things are shaping now it would appear that the postponement had been all for the best.

The danger in this situation lies in the fact that we may have a rapidly falling market, a thing that is dangerous and undesirable. Were this to come to pass we would find buyers leaving the market entirely, or if they remained it would be only to supply their immediate and urgent wants, and there is nothing more miserable than that sort of trading.

Canadian Machinery has discussed this matter with many men in the iron, steel and machine tool field during the past weeks, and when one finds Judge Gary making it the centre of his annual address to the Iron and Steel Institute there is little room to doubt that it is the real question of the hour.

The desirable solution is to keep the buyers in the market. By this we are not urging any buyer to go in hard now. His own common sense, and his knowledge of his own field, must, in the last analysis, determine the size or value of his purchases.

The business world, in many cases, was quick to respond to the touch of higher costs with higher selling prices. Some of them undoubtedly went the limit in this and worked on the principle of piling on all the traffic would bear.

When the tide is running in the opposite direction these same interests, if they are to serve their field well, should be just as keen to make adjustments in the other direction.

If there is a determined all-round resistance to price declines, if there are no mutual concessions, no tempering of contracts to meet changed conditions in any line, then we are facing a serious situation.

What will result? The buyer will be forced to keep out because he will be afraid of being ruined if he buys at high prices, with the prospect ahead of him of selling at a lower level.

If, on the other hand, there is a spirit of reasonable business action, of concession wherever possible, of a desire to consider the proposition and the problem of the other man, then it may be possible to get the country cleared out of the high-cost materials in all lines, much of which is still held in various centres. If the whole loss were shouldered on any one section it would mean ruin in many cases.

The manager of one of our large establishments puts the case well as follows: "Let us be reasonable, and not afraid; we are going through the period of deflation that we thought was coming two years ago, and until we get through it we will never be down to a solid basis where we can go ahead and do constructive work again. Let us guard against doing anything that will bring us face to face with unemployment. Let us keep the buyers in the market even if we make very little money—this is not a season of large profits, and we must realize it. This situation will work out well if we keep our heads, use common sense and attend to business. I am not afraid of it."

Nothing But Wages

IT seems difficult to realize at times the length to which workers have gone in making demands, each of which was like a millstone tied to the neck of industry. In Italy, for instance, when the shops refused a 50 per cent. wage advance because there had previously been a 200 per cent. increase, unions determined on the following programme in order to coerce the employers, which is given in the words of the manifesto issued by the labor leaders:—

1. Production must be reduced to a minimum.
2. Work must be simulated, thus obviating any absurd pretext on the part of the management to resort to dismissal or lockout.
3. No files or other tool should be used unless they be in perfect order and fully suitable to the job on hand.
4. Every repair to machinery must take the longest possible time.
5. Nobody, for any reason, should attend to a different job from the one on hand, as repairs, oiling, etc.

Finally it was stated that if employers dismissed the workmen they should take no notice of the dismissal, but continue to enter the plant. Should the management resort to forcible ejection the men were instructed by their union leaders to proceed to violence. Should a lockout be enforced it was declared that the works should be re-entered at all costs, even by breaking in.

No doubt you will say that was an extreme case. Quite so, but these extreme cases are simply the logical outcome of any system that looks upon successful negotiation of wages and working conditions as securing a jug-handled document, with the handle in their own grasp.

Employers to-day are willing in many cases to meet their men on grounds quite different to those of some years past—if they only get the chance to do it.

There is a new school of employers, and they are, for the most part, vastly different to the old autocratic type.

It is a serious thing for a man himself when the matter of hours and wages get so impressed upon his mind that he speaks, thinks and acts only in this narrowed sphere.

The employer who will not recognize initiative, effort, and industry may exist now, but if he does he represents a fast-dwindling minority.

The sense of accomplishment is greater than the recompense of wages, and the realization of work well done cannot be measured in terms of dollars and cents.

Judge Gary Sanely Optimistic About Future

(By a Staff Representative)

NEW YORK.—The address of Judge Gary to the members of the Iron and Steel Institute is looked forward to each year as a statement that will give the estimate the steel world of United States has of business conditions, and prospects of their betterment or otherwise.

Judge Gary spoke plainly on this matter. There was no effort to mince matters. When the speaker was through reading his address there was a feeling that he had indulged to too great an extent in a description of affairs in Europe, but when, in the lobbies afterward, steel men started to analyze the statement, they found that he had put his finger on the real situation, viz., that it was possible to resist price deflation to the point of keeping buyers out of the market, or, on the other hand, make the concessions necessary to keep the buyers in the market.

Just What Judge Gary Said

Speaking of the matter of prices, Judge Gary said:—

"In certain lines of the iron and steel industry there have of late been some decreases in the volume of new business and also voluntary reductions in selling prices. I consider this decidedly healthful. All, or nearly all, of us have for months been unable to supply the demands of our customers as to quantities or deliveries and our prices, considered as a whole, have resulted in profits. As a matter of course some adjustments will need to be made. The average of the general scale ought to be reduced equitably and relatively. Without referring to individual cases or lines of general business, I believe in many instances prices have been outrageously high. This observation applies more especially to middlemen, so called, and to smaller departments of industry. It also includes employes in certain trades; but it does not pertain under present conditions to the masses of workmen.

"The present tendency is toward a lower, more reasonable and fairer relative basis. The whole community desires and strives for this. The difficulty is found in the fact that every individual is perfectly willing that all others shall make reductions—the larger the better. As there was more or less a scramble for higher and still higher prices when they were advancing, there will be just as much selfishness in the enforced use of brakes when there is a tendency toward decreasing prices. Now, a general public, including particularly those who are neither sellers nor buyers to a large extent, will in one way or another bring about a fair and reasonable readjustment of prices. The law of supply and demand will be the principal factor.

"What shall be our attitude in these circumstances? I answer:—We must evidence the same disposition which was displayed before the Industrial Board in March, 1919, when our steel committee co-operated with the Government's representatives in the endeavor to secure a general, equitable, orderly and methodical reduction in the prices of all commodities and services. Let us be reasonable and just, reducing our prices if and when other reductions and costs permit, and then with level heads, clear minds and honest convictions, stand solid as against panic or lack of confidence in the industrial situation. Let us strive to be right. If we are right we can be determined and courageous. Let us as individuals consider the interest of all others. Our business is basic. It is perhaps one of the most important. We may, we must, exert an influence for stability throughout the business world at a time when readjustments are, more than usually, liable to provoke disturbed conditions."

Agreed That He Was Right

The iron and steel industry of United States attend the Institute meeting. The corporation heads and the independents are always there. It is the big chance the technical and operating heads have to meet the big executives, and also it is the big chance the former have of making the latter sit still and listen. When Judge Gary finishes, the meeting goes on with the discussion of highly technical matters. The steel barons may understand some of the discussion, but the chances are that much of it goes over their heads. But they do not bolt. They occupy the front seats and take their medicine in spite of the fact that practically all the steel men of the country are waiting around to meet them—for, as a matter of fact, there is a general scatteration of the members as soon as Judge Gary is through with his address.

One hears many exchanges of market news—for instance, that a fairly large tonnage of pig iron has sold at $40—that premium mills are doing in some cases as low as six cents on black sheets for Canada, with fair delivery, against 5.35 of the corporation, with no promise of quick action in the matter of shipment.

The rumors that the corporation might advance prices to cover the $50,000,000 which has been added to its freight bills, did not materialize in fact. If there had been any intention of making such a move, or had there been any necessity for it, three months ago was the time when it could have been put across. It would have a hard time trying to gain popularity now—in fact it could not be reconciled with the trend of Judge Gary's remarks, which were all pointed and tuned toward lower levels as soon as possible.

Of blue ruin talk there was none at all, in fact, the head of the Steel Corporation is noted for pruning very severely anything that might be twisted or misconstrued to read like bread-line literature. All through the meeting there was a marked tendency to be frank and honest in discussing affairs and tendencies, and the impression was created that sane optimism and a wholesome confidence in the future could handle successfully the deflation tendencies which are now upon us.

Among important steel makers present besides Judge Gary were Charles M. Schwab, chairman of the Bethlehem Steel Corporation, and Eugene G. Grace, president of the Bethlehem Corporation; John A. Topping, chairman of the Republic Iron and Steel Company; James A. Campbell, president of the Youngstown Sheet and Tube Company; E. A. S. Clark, president of the Consolidated Steel Corporation; Willis L. King, vice-president of the Jones & Laughlin Company; R. P. Lamont, president of the American Steel Foundries Company; Clarence Howard, president of the Commonwealth Steel Company, and W. H. Brevoort, president of the Republic Steel Company.



The Descent.
—Lecocq in the Portland (Ore.) "Telegram."



MARKET DEVELOPMENTS



Volume of Business is Not Very Large Now

Pittsburgh Reports That Buyers Are Not Anxious to Take on Large Tonnages Yet—Machine Tool Market Finds Many Buyers Waiting to See What is Likely to Happen.

THE market is discussing prices more this week than for some time past. The annual address of Judge Gary at the meeting of the Iron and Steel Institute has no doubt helped to direct thought in that channel. The feeling is expressed in many places that the real question of the hour is keeping prices attractive enough to hold the buyers in the market. The opinion is freely expressed that by a resistance of the tendency toward lower levels the buyers may be forced out of the market.

Pittsburgh reports that adjustments are being made in some existing contracts, although they are booked on the non-cancellation basis. Business there is fairly dull, and some of the mills are turning out more tonnage than is being placed on their books. New York also reports that the machine tool market in that centre is quiet. There is a feeling expressed in several quarters that the first of the year will see a revival of buying in many lines.

Supplies of steel are coming to hand fairly well, but there are lines yet where a large unsatisfied business still waits for deliveries. Sheets are scarce and wanted. Tubes come in, but not sufficient, and the prices are firm. Compared with pre-war days, it may be stated that four-inch tube—which is a standard size—to-day sells for 65 cents per foot, against 20c, which may be called a fair pre-war figure.

Machine tool houses are not doing a large business, but there is a scattered selling that is making figures fairly representative, when compared with previous months this year. The small tool trade has the same experience. A large number of small orders is the general report, no very large buying being done.

Scrap metal dealers are waiting for a turn in affairs, as their business is very much unsettled. Even were it to become established on a lower basis they might be able to go ahead, but it does not seem possible to reach that lower level with the knowledge that it will provide a real working basis.

THE IRON AND STEEL MARKETS REMAIN DULL AND LIFELESS

Special to CANADIAN MACHINERY.

PITTSBURGH, Oct. 28.—Few parallels can be found in history for the present dullness of the iron and steel markets. There is no new buying of any consequence in pig iron, none at all in semi-finished steel and scarcely any in finished steel. Pig iron and semi-finished steel contracts are, by trade custom, firm and not subject to cancellation, but there is latitude, particularly in pig iron, as to delivery. Sometimes, as a few months ago, the furnaces are behind in deliveries. Now many consumers are instructing furnaces to defer shipment or reduce the rate of shipment. In finished steel products, while there was a considerable volume of cancelling a few weeks ago there is further cancelling even now, together with many requests for postponement of shipment. If a correct statement could be prepared it would probably show that the independents as a whole are losing more by cancellations and postponements than they are gaining by booking new business, while, of course their order books are thinning each day by the amount that they ship.

Sometimes when orders fall off the iron and steel producers get into a pessimistic frame of mind and look on the dark side of things. That is not the case at this juncture. Those who held their prices down and those who sought the highest price obtainable, during the scarcity, realized very well that the situation could not last and that a stable basis with reasonable profits would have to be established some time, fair prices resulting in a healthy and full demand eventually. That is the prospect the producers are now looking forward to. There will have to be lower prices and there will have to be a period of light operation, but prices are not expected to become really unprofitable and the period of light operation is not expected to last long.

Producers Variously Situated

The steel market is a very disorderly one, and it is uncertain in what manner prices will decline and how long the decline will require. This complexity results from the producers being situated so variously. In times past, when demand stopped, the mills, or at least the large mills, would find themselves all in about the same position as to the volume of business on books. Then it was a clear case of holding prices until as much tonnage as possible had been squeezed out of the contracts. Eventually a point would be reached when there was more business to be obtained by reducing prices than by holding prices and shipping on contract.

Now, however, the mills are very variously situated. The Steel Corporation is booked for an average of about nine months. Some of the large independents are booked for three or four months, provided the market stays up moderately well. Other large independents have much less business on books. Among the small mills a few have a good volume of business but some have practically nothing. The state of order books to-day depends upon the price policy pursued this year. The mills that sought the highest prices had to keep their order books clear so as to be able to make early deliveries, for it was early deliveries that brought the highest prices, and at the same time they were quite unable to sell ahead. These mills have made a great deal of money and can well afford to sell at very low prices, even below cost, for the purpose of buying their way into the trade again. Some,

however, seem to prefer idleness. Instances are cropping out of a mill that was formerly one of the very highest priced sellers being now the lowest priced seller among the independents.

Steel Bars Cut

The Pittsburgh Crucible Steel Company suddenly began offering merchant steel bars in rounds, squares and flats, at 2.35c, which is the Steel Corporation price. Other independents have been quoting 3c to 3.25c, and while they learned within a day or two of the cut, they assert they will not meet the cut or even reduce prices, preferring to sit back and let the company involved fill up. In the past few weeks bars have been considered one of the strongest, if not the strongest, item in the whole list of steel products.

In plates the majority of the mills are naming 3.25c as "the market" and then cutting this figure, on individual inquiries, down to 3c as the limit. There are exceptions, however. Two western mills have quoted 2.65c and 2.75c respectively, and a sales representative of one of the mills is reported to have canvassed his trade offering to go $1 a ton below any quotation received elsewhere.

While it is still uncertain whether steel prices will experience most of their decline in the next few weeks or will hold, for, say, two or three months and then begin their real decline, predictions are already beginning to appear as to how long the general readjustment will require, the prediction being that next April will see the turning point, with prices at their minimum and with buying increasing.

There is much discussion as to the attitude of the United States Steel Corporation, which has maintained up to date the Industrial Board prices of March 21, 1919, except for two or three little advances made last August. There have been continued rumors for two months past that the corporation would advance its prices slightly, by an average of $3 or $4 a ton, based on the increasing costs caused by the freight rate advances of August 26. This would give the independents some encouragement to drop to the corporation price level. There is, however, the factor that since the war-time control there has been no realignment of prices, one price with another, on the basis of production cost and relative demand, and a horizontal advance in the Steel Corporation prices would hardly produce a fair and equitable price structure. Very few predict, however, that the independents will reduce their prices just to the Steel Corporation level, whatever that may be, the view being that when the independents get down to the corporation level they will have to cut under the corporation prices in order to get business.

Pig Iron and Coke

Two or three small lots of basic pig iron have been sold by furnace interests at $40, valley, marking a further decline in the market of $2 a ton, a total of $8.50 from the top price, reached late in August. In Bessemer iron there is recorded a decline of $1.50, to $47, valley, as a furnace interest has formally offered iron at that figure, though, as a matter of fact, a single carload represents the only sale actually reported. Foundry iron remains quotable at $47, valley. An inquiry for a round tonnage would no doubt develop a lower price, but the inquiry must first appear.

Pig iron cannot find its true level as long as coke is at an altogether fictitious level. There has been a spectacular decline in coke in the past week, but there is still much distance to travel. In approximately a week Connellsville furnace coke for spot shipment has dropped from $17 to $14. Foundry coke lags in the decline, being quotable at about $17, but in time it will respond to the furnace coke market. A price of $8.50, or half the recent $17 price, may be seen within a fortnight or a month, but as even that would be nearly six times the $1.50 price that prevailed in May, 1915, no one can say where the coke market will stop.

POINTS IN WEEK'S MARKETING NOTES

The independent steel mills are probably losing more by cancellations and postponements than they are booking in new business.

One Pittsburgh company has cut the price of merchant steel bars in rounds, squares, and flats to 2.35.

Quite a tonnage of basic pig iron has been disposed of at $40, which is quite a reduction from the high figure that was being exacted in August.

Machine tool business is fair in this district, but buying is scattered and not in large lots.

Boiler tubes are arriving, but there is still a large unfilled demand. They are still selling at 65c for a 4 in. tube against a price of 20 cents prior to the war.

New York machine tool market continues very dull, with few large buyers in sight.

A number of U. S. machine tool makers have been approached with a view to lowering their prices, but they are standing firm against such a move.

KEEP BUYERS IN THE MARKETS NOW

That Should be the Aim of the Dealers in all Lines as Far as Possible

TORONTO.—The machine tool, steel and iron trade has seen much better days than it is experiencing in this district just now, but the dealers are not inclined to complain. Some of them thumb over their records and find that June was just as bad as October is likely to turn out to be.

As has been the case for some time, there are no large buyers in the market. Rumors of fairly large lists having been put out are heard, but buying has not started with the movement that is likely to come a little later on.

Prices are still holding firm in nearly all lines of tools, although dealers are not saying much about this matter. Makers have given little indication of any intention on their part of cutting their selling prices.

Firms that sell to farmers report a good business. There is an increasing volume of trade in this way, as farmers are more and more equipping their premises with lighting sets and other forms of modern equipment.

Clearing the Stock

Steel merchants are having a good business, but there is not the pressure on them there was a month or so ago.

Many local dealers are not buying from the independents now. Neither are they getting deliveries from the corporation. Bookings placed with the latter a year ago in some cases are still unfilled. "We are going to get better figures from the premium mills now than before," stated one dealer, "and I would not be surprised to see them doing better than six cents, although I do not know of an actual case where less than 6.50 has been paid. When one considers that the Corporation price to Canada is 5.35, with no quick delivery, it is much better for us to get a tonnage from the mills at 6.50 with delivery. We don't mind paying 6.50 for black sheets now, as costs are still high, but when we had to put up as high as 8c a pound to bring sheets over here, it was too much and too dangerous to last long."

Making Concessions

The head of one of the merchandising firms in the steel trade stated to Machinery this morning: "There must be now a gradual bringing down of prices in all lines, and in order that this may be done there will have to be concessions made, and we are following this policy now. I believe it should be generally done, not in the way of price slashing, but in order that the price list may be kept interesting enough so that the buyers will not go out of the market and stay out. If we can work along this way for a time, we will arrive at a basis where business can go on without any

trouble. In this way it will be possible to avoid a period of unemployment, and it is very desirable for the present that we have as little unemployment as possible."

Have Lists Out Now

Quite a number of the manufacturers have lists out now of material on hand of which they wish to dispose. "It all goes to show," stated one dealer this morning as he looked over several of the lists, "that it is easy to get people to buy when the markets are high and rising, and when it is difficult to secure material. Many firms have gone ahead and bought wherever they could because they were afraid of having no supplies at all to fall back on. Now they are not so busy and stock is piling up on them." Dealers as a general thing are not much interested in the lists that are being sent out by the manufacturers, as in many cases they, the dealers, have all the material in stock and on the way that they can take care of in the present market."

Tubes are arriving in fair quantities now, but they show no sign of coming down in price. A fair comparison in price shows that in 1914 a four-inch tube was selling at about 20c per foot, while now the quotation is 65 cents. There is, the mills claim, difficulty in securing skelp for the making of tubes, and the feeling is that this will be one of the last lines to come down.

The demand for reinforcing is not very keen now, as the season is pretty well over.

One dealer made it plain to-day that he thought buyers would make a mistake if they stayed out of the market now in the hope of buying much cheaper later on. He did not counsel placing a heavy order now, as he was of the opinion that price changes might be made, but his point was that if buying ceases it will react all the way through and bring about unemployment, whereas, if all the different factors in trade adopt a reasonable attitude it will be possible to gradually get the high cost material out of the trade entirely without an overwhelming loss having to be borne by any particular person or firm.

Some of the offices seem to be getting a very fair share of business in small tools, although in no case is anything heard of large lists having been sent out. There is a rumor in the market that there may be some readjustment of prices, having special reference to high speed drills. There is nothing official in regard to the matter, but it comes from a very reliable source.

The scrap market has no interesting spots. The trade was in hopes that the recent adjustment of prices, which brought prices down, would react on scrap and cause dealing to get under way again at a lower level. This has not happened at a lower, higher, or the same level and business drags.

BRITISH TOOL MAKERS IN NO RUSH TO BRING DOWN THEIR PRICES

THAT British machine tool makers are in no hurry to lower prices, but that competition in weeks to come would decide their course to some extent, is the impression one gains from discussing the matter with Mr. P. V. Vernon, a director of the firm of Alfred Herbert, of Coventry, England.

"The condition of labor is not the most settled thing with us," remarked Mr. Vernon. "In fact we often are in the position of wondering what is coming next. Not many months ago there was a ruinous strike of the moulders, and just now the miners have quit work. Then machinists were out, and other engineering trades are talking strike. It all makes manufacturing conditions rather unsettled. With material we are not having much trouble obtaining it all at home, but the price we are paying is still high."

The system of taxation that is in vogue seems to have the tendency of keeping prices up. Manufacturers are allowed to make the same profit as they did in the two years previous to the war. Anything over and above that comes under the heading of excess profit, and of that the Government takes 60 per cent. and leaves the manufacturer with 40 per cent.

The competition in the machine tool business of the Old Country makers is pretty well divided between their contemporary firms at home and the U.S. builders. "Business has changed since the signing of the armistice," stated Mr. Vernon. "When the war was on our product was almost 100 per cent. for home consumption, it being all used in the turning out of munitions. Shortly after there came a change until we found that our business was one-eighth foreign and the rest home. When I left the figures showed that one-third of the business was foreign and the rest for home use. There has been a falling off in many lines, but it is common all over the world. I have been for some weeks in the machine tool and manufacturing centres of United States and I know that many of the big shops there are not booked very far ahead with business, neither are the big shops, such as the auto works, buying anything in the way of equipment just now."

British firms are not paying much attention to German trade yet. The German mark is so low in value that the Germans themselves cannot afford to buy from British firms, and the impression is gathered that as a rule the British firms are not particular about opening up trading with the German people.

Mr. Vernon is a firm believer in British houses wishing to open up for business in Canada making a personal study of the field here. "The ways of doing business are quite different in various countries," is his contention, "and once a person has been in Canada he understands far better the problem of the office or the representative here. Our British firms have been advised many times to do this very thing, to make a visit to the field and meet the people and find out their ways of doing business, and I am more firmly convinced than ever that it is a splendid thing for a British manufacturer to do."

The British makers of machine tools of the better class are not at all afraid of not being able to meet the competition of the rest of the makers. For a time the Japanese were putting a cheap tool on the market. They took one of the Alfred Herbert machines and called it—or rather the imitation machine they made from it—the "Alf," and put it out to the trade. "That move did not hurt us at all," remarked Mr. Vernon, "in fact the imitation and the use of part

TOOL BUILDERS ASKED TO REDUCE

But So Far Their Attitude is Based on Relation to Cost Prices

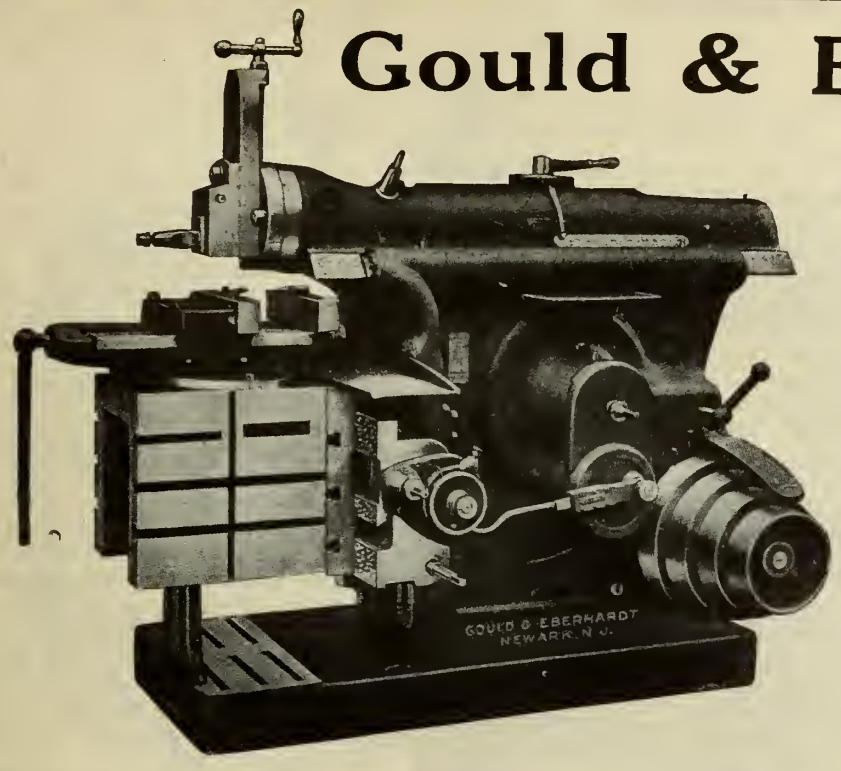
Special to CANADIAN MACHINERY.

NEW YORK, Oct. 28.—Aside from inquiries from the Reading Steel Casting Co., Reading, Pa., for 25 or 30 tools for an addition to its plant, there is little activity in Eastern machine tool markets. Business certainly shows no signs as yet of revival, and sellers do not look for any change in the situation until after Presidential election, and some go so far as to predict that present conditions will continue until the first of the year or later.

There are some scattered orders for single tools, but a majority of sellers in this market are doing little or nothing in the aggregate, as compared with what might be considered a normal business.

Some of the automobile companies have been conducting a sort of organized campaign to induce manufacturers in all lines to bring down prices. Some machine tool manufacturers, thus approached, have signified that they have no present intention of reducing prices; that their selling prices are based on production costs, plus a reasonable profit, and that they do not intend to change prices until costs can be reduced. There are some evidences of labor costs coming down, through the willingness of men out of jobs to work for less than they have been getting in the past year or two. Material costs, however, are not lower, as most manufacturers of machine tools are still getting high priced pig iron, castings and steel on contracts made some time ago.

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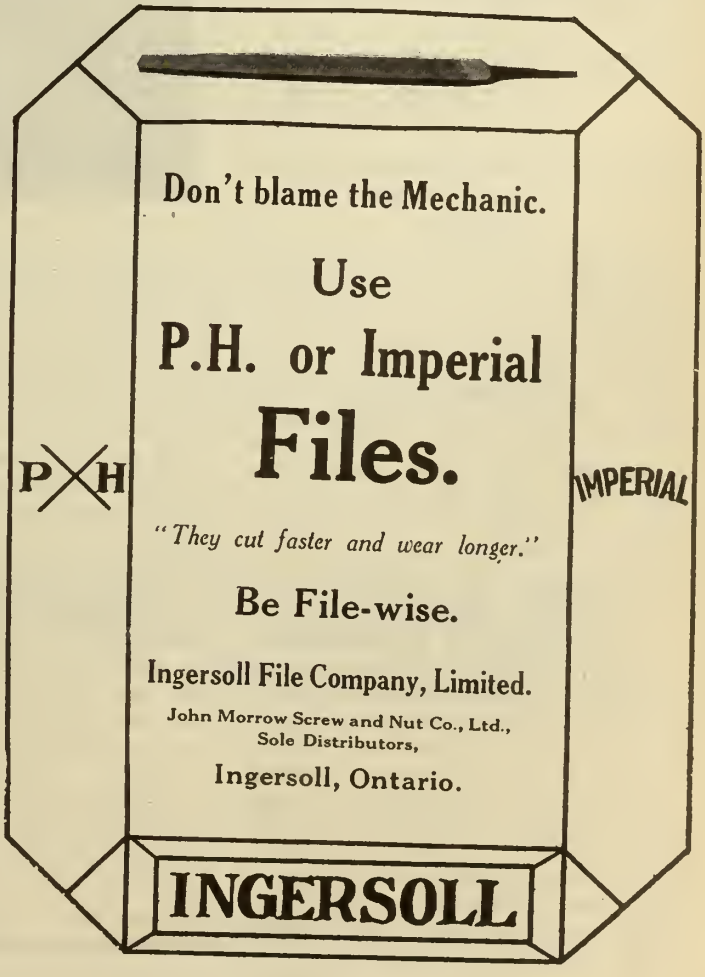
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MONTREAL CANADA



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of our name never injured our business. As soon as we were able to put out tools after the war the Japanese imitation did not provide any real competition."

This is Mr. Vernon's first visit to Canada. With Mrs. Vernon he has been spending some weeks in United States before coming to this country. Together with Mr. Blair, the Canadian representative of the Alfred Herbert Co., he is making a study of the Canadian field with the idea of further extending their business in this country.

WON'T TAKE GOODS—EXCHANGE BLAMED

South American Firms Take Action That May Cause Great Loss

Buenos Ayres.—At a meeting here of representatives of American commission houses it developed that the total value of American goods rejected at this port owing to the falling prices and high exchange on the American dollar approximates $12,000,000.

Other large consignments of American goods are now en route to Buenos Ayres, and leading American firms are fearing a crisis unless the Federal Reserve administration relieves them from operation of the re-discount rules.

Most of the rejections were noted with regard to textiles, foodstuffs, machinery and steel.

CONDITIONS O.K. IN SCOTIA FIELD

Agreement Has Been Reached in Regard to Taking Iron Ore From Mines

Montreal.—Roy M. Wolvin, president of the Dominion Steel Corporation, returned after a two weeks' trip to the company's properties in Nova Scotia and Wabana. The steel industry, he said, was in a satisfactory condition, and he had been able to arrive at an agreement with the Newfoundland Government whereby the export of iron ore would be carried out under conditions favorable to the corporation and along the lines desired by those who had conceived the British Empire Steel Corporation.

A Worthy Booklet.—The reasons why American manufacturers are establishing plants in Canada at the rate of one a week are summarized in a booklet just issued by the Union Bank of Canada, entitled "A Canadian Plant—Why?" In the face of the growing strength of the "Made-in-Canada" movement, and the extension of the British Preferential Tariff, Canada, the booklet claims, is the logical location for a plant with which to handle British and Canadian trade.

F. H. WHITTON DIES IN HAMILTON

General Manager of Steel Co. of Canada Failed to Rally from Operation

Hamilton. — F. H. Whitton, general manager of the Steel Company of Canada, died at St. Joseph's Hospital, Hamilton. Mr. Whitton failed to rally from a serious operation performed on October 21.

In the death of Mr. Whitton, Hamilton loses one of the leading figures in its commercial life. Deceased was born in Northamptonshire, England, 61 years ago, and spent his early youth in that country. He attended college at Cambridge, but when 18 years of age came to Canada and entered the employ of the Grand Trunk Railway at Montreal. He later removed to the United States, but returned to Canada to assume the management of the Ontario Tack Company, which position he held till 1907. When the Steel Company of Canada was formed Mr. Whitton was appointed assistant general manager and in 1916 became general manager.



F. H. WHITTON.

Mr. Whitton was prominent in social and religious life, as well as in the commercial world, being a devout Roman Catholic and a member of many clubs. He attended St. Joseph's Church. His wife and one son, Corbett F. Whitton, assistant secretary of the Steel Company of Canada, survive.

Building Addition.—A four-storey addition is being made to the plant of the Fisher Body Company, of Canada, Ltd., at Walkerville, Ontario, and will be completed about the end of the year. The new building is of heavy mill construction and will have 75,000 square feet of floor space. It will be used for painting and trimming closed automobile bodies. When it is in operation the capacity of the closed body department will be increased about 80 per cent. The estimated cost of the addition is $275,000.

INCORPORATIONS

Incorporation has been granted to the British Radio Corporation of America to make, buy, sell, lease, etc., electric appliances of every description, including wireless, telephone apparatus, etc. Head office at Montreal, and capital stock $10,000.

The Hamilton-Bothwell Oil Co. has been incorporated at Bothwell with a capital of $300,000, to operate and deal in gas and oil lands, etc.

Ira Sessenwein Ltd. has been incorporated to carry on the business of scrap dealers in metals, rubber, etc. Place of business to be at Montreal, and capital placed at $30,000.

Incorporation is granted to "All-British Signal Company," with a capital of £80,000, and head office in Toronto. The company is to make or sell submarine signalling made by John Gardner.

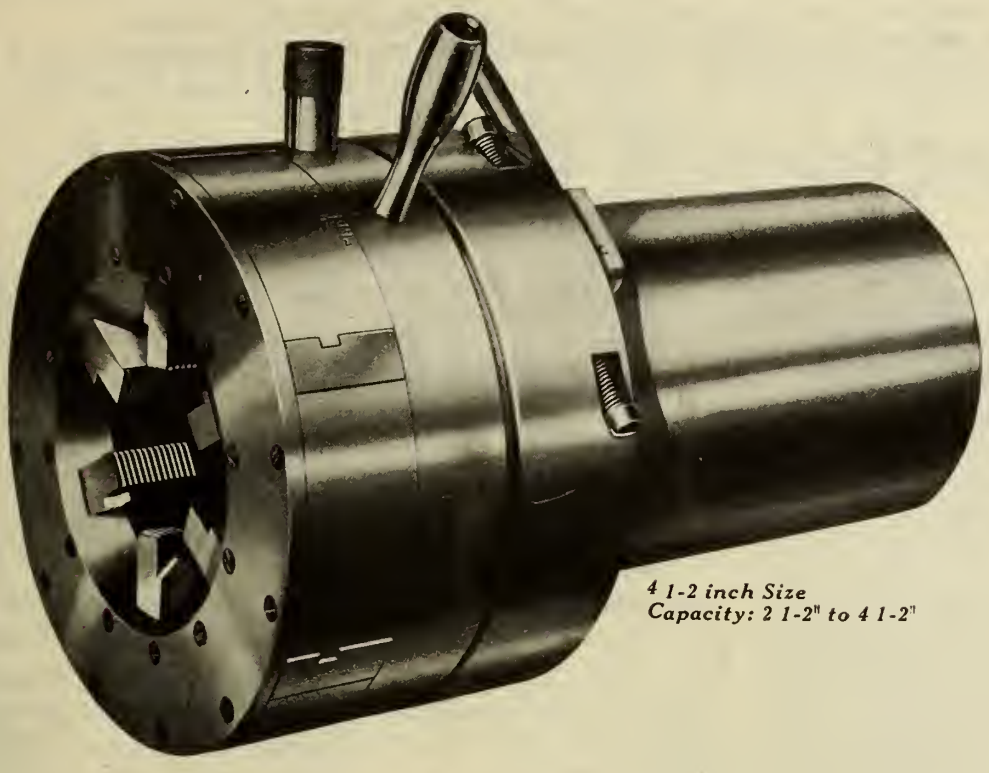
Incorporation is granted to the Overseas Export Co. of Canada, to import, export, etc., all kinds of merchandise, machinery, chemicals, etc. The head office is to be at Montreal, and the capital is $100,000.

Dunwin Motors has been incorporated to buy, sell, trade in and make motors, autos, etc. The place of business is at Montreal and the capital is placed at $100,000.

During the war the shortage of copper induced the Germans to experiment with all kinds of substitutes, and it was found that iron acted satisfactorily for spacing pieces in steam turbines, but not for vanes. Nickel-plated or enamelled steel also failed to answer for this purpose. More promising results are expected, according to "Technik und Wirtschaft," from nitrogenized iron, prepared by a process in which the heater vanes are exposed to a current of gaseous ammonia, the nitrogen of which combines with the iron, while the hydrogen reduces any superficial oxide.

Coming to Canada?—A London, Eng., despatch says: "A big increase in emigration to Canada may be one result of the strike of British coal miners. Reports received from Morriston, near Swansea, Wales, state that many of the steel workers there who have been made idle by the strike have decided to emigrate to Canada at an early date.

Kingston. — The largest locomotive ever turned out of the Canadian Locomotive Works left the plant to go into commission on the G. T. R. It is of special design for hauling heavy freight trains over difficult grades, and will be employed as a transfer engine between Toronto and York.



4 1-2 inch Size
Capacity: 2 1-2" to 4 1-2"



5-16 inch Size
Capacity:
3-32" to 5-16"

The Screw Machine Man Says:

"Everybody recommends Geometric Die Heads. Better Threads in Quicker Time is the reason"

It doesn't matter how strenuous the job is, a Geometric is built to handle it easily.

Make Screw Thread-Cutting the Most Satisfactory Operation in Your Shop.

——Write——

THE GEOMETRIC TOOL COMPANY
NEW HAVEN CONNECTICUT

Canadian Agents:

Williams & Wilson, Ltd., Montreal
The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg, St. John, N.B., Halifax, N.S.
Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta

If interested tear out this page and place with letters to be answered.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 75
Steel bars, base, Toronto	5 75
Iron bars, base, Montreal	5 75
Steel bars, base, Montreal	5 75
Reinforcing bars, base	5 75
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 10
Chequered floor plate, 3-16 in.	8 50
Chequered floor plate, ¼ in.	8 10
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	5 75
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 67 to 5 50
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58½	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

METALS

	Gross. Montreal	Toronto
Lake copper	$24 00	$23 50
Electric copper	24 00	24 00
Castings, copper	23 50	24 00
Tin	54 00	55 00
Spelter	9 00	10 50
Lead	9 50	9 50
Antimony	9 50	12 00
Aluminum	36 00	37 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 35
Plates, ¼ up	6 50	6 60

PIPE—WROUGHT

Standard Buttweld Pipe

Per 100 Ft.

	Steel		Gen. Wrought Iron	
	Blk.	Galv.	Blk.	Galv.
⅛	$ 6 50	$ 8 50	$.....	$.....
¼	5 31	7 41	5 91	8 01
⅜	5 31	7 41	5 91	8 01
½	7 10	8 63	7 95	9 48
¾	8 80	10 87	9 95	12 02
1	13 01	16 07	14 71	17 77
1¼	17 60	21 74	19 90	24 04
1½	21 04	25 99	23 79	28 74
2	28 31	34 97	32 01	38 67
2½	44 73	55 28	....	....
3	58 52	72 29	....	....
3½	74 06	90 62	....	....
4	87 75	107 37	....	....

Standard Lapweld Pipe

Per 100 Ft.

	Steel		Gen. Wrought Iron	
	Blk.	Galv.	Blk.	Galv.
2	$32 01	$ 38 67	$35 71	$42 37
2½	48 26	58 79	54 11	64 64
3	63 11	76 88	70 76	84 53
3½	75 90	92 46	85 10	101 66
4	89 93	107 55	100 83	120 45
4½	1 05	1 29	1 30	1 54
5	1 22	1 50	1 52	1 80
6	1 58	1 95	1 97	2 33
7	2 06	2 53	2 53	3 01
8L	2 16	2 66	2 66	3 16
8	2 49	3 07	3 07	3 64
9	2 98	3 67	3 67	4 36
10L	2 77	3 41	3 41	4 05
10	3 56	4 39	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.

4½" and larger, 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%.

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

Per 100 Pounds.	Montreal	Toronto
Copper, light	$14 00	$14 00
Copper, crucible	17 00	18 00
Copper, heavy	17 00	18 00
Copper wire	17 00	18 00
No. 1 machine composition	17 00	17 00
New brass cuttings	11 00	11 75
Red brass turnings	14 50	15 75
Yellow brass turnings	9 00	9 50
Light brass	6 50	7 00
Medium brass	7 50	7 75
Scrap zinc	6 00	6 00
Heavy lead	7 50	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00

	Per Ton	Gross
Heavy melting steel	20 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	30 00	20 00
Rails (scrap	23 00	18 00
Malleable scrap	26 00	25 00
No. 1 machine cast iron	36 00	33 00
Pipe, wrought	12 00	12 00
Car wheel	33 00	33 00
Steel axles	25 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	28 00	25 00
Cast boring	14 00	14 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	+10
Carriage bolts, ⅜-in. and less	Net
Coach and lag screws	—15
Stove bolts	55
Wrought washers	—25
Elevator bolts	+10
Machine bolts, 7-16 and over	+10
Machine bolts, ⅜-in. and less	+10
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 50
Nuts, hex., tapped	add 3 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws —20% 25 and	5
Sq. and hex. hd. cap screws	12½
Rd. and fil. hd. cap screws	plus 25
Flat but. hd. cap screws	plus 50
Fin. and semi-fin. nuts up to 1-in.	12½
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	—5
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	+12½
Studs	+5
Taper pins	—12½
Coupling bolts	+40
Planer head bolts, without fillet, list	+45
Planer head bolts, with fillet, list plus 10 and	+55
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	+60
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add +85
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

Per gross ton	
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails, base	$6 10
Cut nails, base	7 00
Miscellaneous wire nails	50%

ROPE AND PACKINGS

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28

POLISHED DRILL ROD

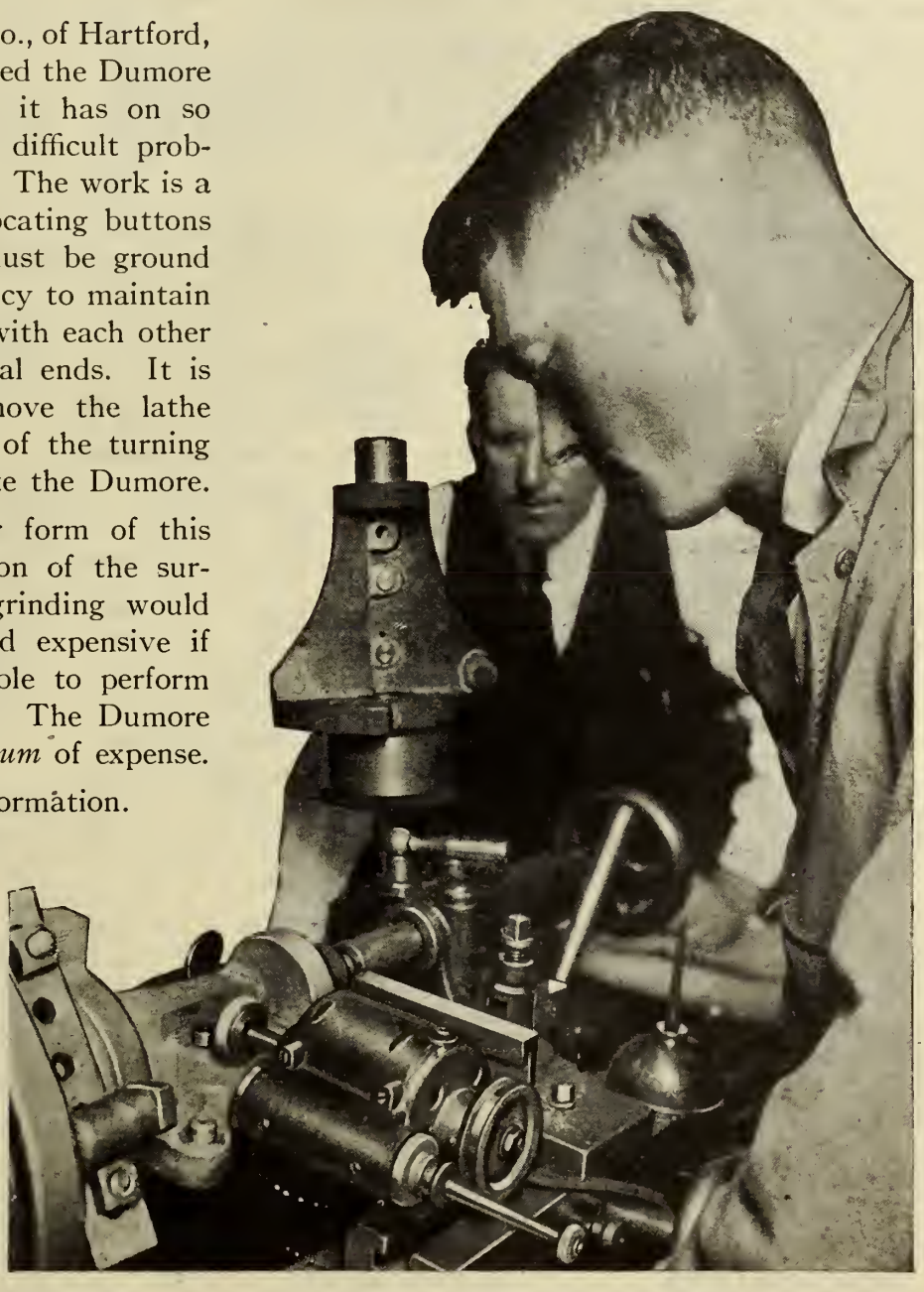
Discount off list, Montreal and Toronto net

Planning and Producing with the Dumore

THE Reid Motor Co., of Hartford, Conn., has selected the Dumore Grinder because it has on so many occasions solved difficult problems for this Company. The work is a fixture with certain locating buttons and surfaces, which must be ground with the utmost accuracy to maintain their correct relations with each other and with the cylindrical ends. It is necessary only to remove the lathe tool at the conclusion of the turning operation and substitute the Dumore.

Owing to the peculiar form of this casting and the location of the surfaces to be ground, grinding would have been difficult and expensive if not altogether impossible to perform on any other machine. The Dumore did it—*and at a minimum* of expense.

Write for complete information.



WISCONSIN ELECTRIC COMPANY

2428 Sixteenth Street
RACINE, WISCONSIN

DUMORE HIGH SPEED GRINDERS

If interested tear out this page and place with letters to be answered.

MISCELLANEOUS

Solder, strictly	$ $ 29½
Solder, guaranteed	0 31½
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	20 35
Red dry lead, 100-lb. kegs, per cwt.	16 00
Gasoline, per gal., bulk	0 42
Pure turp., single bbls., gal.	3 15
Linseed oil, raw, single bbls.	2 37
Linseed oil, boiled, single bbls.	2 40
Wood alcohol, per gal.	4 00
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	10 to 30
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	70	85
Class B	30	40
Class C	20	30

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$12 00	$10 50
Sheets, Blue ann., No. 10	9 50	9 00
Canada plates, dull, 52 sheets	13 00	13 00
Can. plates, all bright	14 00	.....
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	13 50	.....
Fleur-de-Lis, 28 B.W.G.	13 00	.....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	12 00
Premier, 10¾-oz.	11 50	12 40
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	35 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	29½
Palacine	32½
Machine oil, per gal.	65
Black oil, per gal.	34
Cylinder oil, Capital	1.01
Petroleum fuel oil, bbls., net	19

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	6½
Standard	6½
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	11
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	.24	Atlas	.20
Peerless	.22½	X Empire	.19½
Grand	.22½	Ideal	.19
Superior	.22½	X Press	.17½
X L C R	.21		

Colored

Lion	.17	Popular	.13
Standard	.15	Keen	.11
No. 1	.15		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.20	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	49 00	48 00
Copper sheet, tinned, 14x60, 14 oz.	52 00	48 00
Copper sheet, planished, 16 oz. base	56 00	55 00
Braziers', in sheets, 6 x 4 base	48 00	46 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$11 50	$14 50
Sheets, 3½ lbs. sq. ft.	11 25	14 00
Sheets, 4 to 6 lbs. sq. ft.	11 00	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.04
Acid, nitric	.11
Acid, sulphuric	.04
Ammonia, aqua	.15
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy	.41
Copper, sulphate	.15
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.20
Nickel carbonate	.32
Nickel sulphate	.22
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.30
Silver nitrate (per oz.)	1.25
Sodium bisulphate	.14
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.10

Prices per lb. unless otherwise stated

Aikenhead's "Everything in Tools"

DUMORE

High Speed Electric Grinders



No. 1 Dumore Grinder

Speed....20,000 R.P.M. ⅛ H.P. Motor
Reach of Arm ..... 4½ in.
Reach of Extension ..... 2 in.
Net Weight ..... 5½ lbs.
Shipping Weight ..... 10¼ lbs.



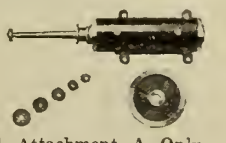
No. 20G Dumore Centre Grinder

Speed....10,000 R.P.M. 1/6 H.P. Motor
Reach of Spindle ..... 2½ in.
Net Weight ..... 12½ lbs.
Shipping Weight ..... 25 lbs.

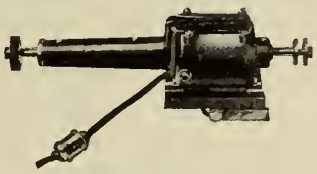


No. 2AG Dumore Grinder

Speeds.....10,000 and 30,000 R.P.M.
1/6 H.P. Universal Motor
Reach of Int. Spindle ..... 3 in.
7 Elastic Wheels ..... ⅜ in. to 4 in.
Hardwood carrying case
Net Weight ..... 15½ lbs.
Shipping Weight ..... 28 lbs.

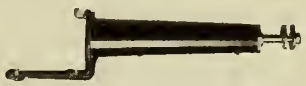


Internal Attachment A Only.
All attachments are interchangeable on No. 2 Grinder.

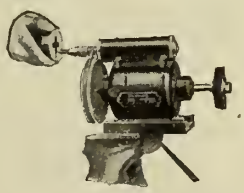


No. 2BG Dumore Grinder

Speed....10,000 R.P.M. 1/6 H.P. Motor
Reach of Arm..... 10 in.
Net Weight ..... 18 lbs.
Shipping Weight ..... 34 lbs.

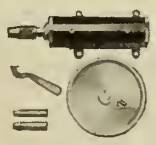


Extension Arm B Only.
All attachments are interchangeable on No. 2 Grinder.



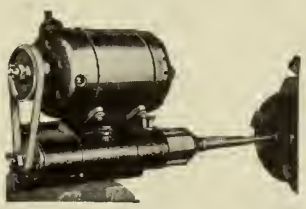
No. 2CG Dumore Grinder

Button Die Grinder .... 1/6 H.P. Motor
Speeds .....10,000 and 50,000 R.P.M.
Net Weight ..... 15½ lbs.
Shipping Weight ..... 28 lbs.



Button Die Attachment C
All attachments are interchangeable on No. 2 Grinder.

Aikenhead's, "Canada's Leading Tool Supply House," can fill your requirements promptly. Write for full particulars of these or any other tools for the tool-room or woodworking shop.



No. 3 Multi-Speed Dumore Grinder

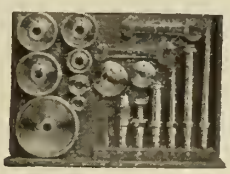
Seven Grinding Speeds, 3,600 to 50,000 R.P.M. (¼ H.P. Universal Motor).

Equipment :

12 Emery Wheels 3/16" to 5" in diameter; 2—⅜" Emery Pencils; 5 spindles, 2 wheel arbors and chuck. Reach of largest spindle 6". SEVEN QUICK change pulleys give any speed desired.



Grinding Wheel equipment regularly furnished with No. 3 Multiple Speed Dumore Grinder.



Pulleys and Spindles and Wrenches used in getting the big variation in speed of No. 3 Multiple Speed Dumore Grinder, as specified in No. 3 Multi-Speed Dumore Grinder.

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If interested tear out this page and place with letters to be answered.



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES



LOOKING FOR BETTER TRADE EARLY IN THE COMING YEAR

REFERENCE to business conditions, present and prospective, is contained in the following opinions:

"In connection with the present and future possibilities of galvanized sheets," said Mr. A. T. Enlow, president of the Dominion Sheet Metal Corporation, Ltd., Hamilton, Ont., "we might summarize the situation as follows: present supply, none; immediate prospective supply, fair; next spring, usual rush.

"It is evident therefore that the wise buyer will order before January 1 and as prices are declining somewhat and may sag a little lower he will lose nothing by so doing.

"There will not be any radical decline, in fact the decline already made is possibly the limit in this swing.

"Underlying basic business is good, especially in Canada, and with the election in the U.S. over on November 2 and the Republican candidate elected, as now seems very probable, business there will also be stimulated and Canada will get the usual reflex glow."

Prices Are Firm

"Your present request for our opinion of the business outlook for the immediate future is rather difficult to answer, but we will begin by saying that we are optimistic," said Mr. L. H. Laythe, sales manager Butterfield & Co., Rock Island, Que.

"We can see nothing in the present situation to cause undue alarm. That we have reached the crest of the long-extended high price movement and are now beginning the descent on the other side cannot be questioned.

"It was all expected, however, by clear thinking business men, and they have only been fooled in that it took longer to reach the peak than was anticipated

"The law of supply and demand is inexorable, and was bound to bring about a readjustment of values sooner or later. and as long as the condition thus brought about is looked upon sanely and all steps and actions in business ventures governing and carried out accordingly, we can see no cause for worry.

"From our own standpoint as manufacturers of small tools, we can see little possibility of any change in prices for the present at least. Radical increases in freight rates, coupled with the fact that raw material in the shape of tool steel and malleable castings shows no reduction, make it impossible for us to reduce our prices now.

"Our advice to jobbers and large users is to buy what they need to keep their stocks well sorted, but not more than can be turned over in a reasonable length of time.

Progressive Swing Next February

"Finally it is our opinion that with the presidential election over in the United States, the crops moved in the Canadian West, a highly satisfactory holiday season at Christmas time, and the usual January first inventories out of the way, that about the first of February of the new year will see things on the progressive swing again, and in a much more healthy condition than at any time since the war began."

NATIONAL CASH REGISTER TO ADOPT PROFIT-SHARING PLAN

The profit-sharing plan adopted by the National Cash Register Company, Ltd., was explained to the employes recently by Frederick B. Patterson, vice-president of the company. The arrangement is characterized by an extreme liberality towards the employes, calling for an equal division of profits between the company and those employes who are not members.

The profits of the company are to be determined by an outside firm of accountants. From the total profits will be deducted an amount equal to six per cent. on the company's investment. not including the value of patents and "goodwill." To offset this six per cent., the employees will receive the highest wages paid for their class of work.

The remaining profits will then be divided equally, the fifty per cent. which goes to the employees being paid in cash as near as possible to the half-yearly accounting dates. The fifty per cent. which goes to the company may be kept in the business for new buildings, machinery, extensions, etc. The employes receive their share unconditionally.

For the operation of the plan the employes are divided into five groups. The first, executives, will receive 12 per cent. of the total profits; the second, foremen, 5 per cent.; the third, job foremen, 8 per cent.; and the fourth, all who have been employed over one month and are not in the first three classes, 25 per cent. Only the fifth group, those who have been in the company's employ less than thirty days, do not share. Each man's share is based on the salary or wages received at present.

Officials of the company expect that the gain in loyalty and production and the decrease of labor turnover resulting from this scheme will make for an increased fall's business. The policy of the company has always been to consider the good of the workers and it has been justified by their success.

Better Times Ahead.—In connection with the annual meeting of the Russell Motor Car Co., Lloyd Harris, president of the Willys-Overland Co., said in referring to the automobile plant on Weston Road, Toronto: "This company has completed the conversion of its plant from aeroplane engine work to automobile work, and during the first six months of the calendar year enjoyed an active demand for its product. Since July 1, in common with other motor companies, it has experienced a contraction of sales and its operations are being carried on at the present time on a reduced basis. It is expected that there will be a renewed demand after the first of the year when the returns from the crops have had time to get into circulation."

Order Engines.—The Canadian Locomotive Company has received an order for four locomotives for the Timiskaming Line, Timiskaming & Northern Ontario Railroad. It is stated that this order will make about 28 engines yet to be completed. At the present time the men in the works are busy on ten locomotives which are being built for the Grand Trunk. It is understood, with the present orders on hand, it will mean that the company will have lots of work until some time after the first of February.

ATKINS

STERLING QUALITY SAWS and TOOLS

A Perfect Saw for every Purpose

"Finest on Earth"

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We make a complete line of Sterling Quality Saws, SawTools, Machine Knives and Mill Specialties. Your request for literature descriptive of our products will receive prompt attention. Write today to the nearest point named below.

You can purchase Atkins products from all distributors in the United States, Canada, Great Britain and France; in fact in all civilized countries. If they do not have in stock the particular saw or machine required, they will get it for you.

If you have difficulty in obtaining Atkins Saws and other products through your regular service, write

E. C. Atkins & Company

Established 1857

Canadian Factory: HAMILTON, ONTARIO

Branch: VANCOUVER, B. C.

TRADE GOSSIP

Operating at Midland. — Industrial prospects are exceedingly bright for Midland, where there is plenty of hard coal for every home at $18 a ton. The Midland Iron and Steel Company's plant resumes operations this week after a shut down of several months. The plant closed down early in the spring in order to re-line the furnace, but the shortage of coke caused a further cessation.

Erecting Big Plant.—Announcement is made of the sale in Toronto of five acres of land at the corner of Hanson Street and Coxwell Avenue, where there is at present a Grand Trunk Railway siding. Plans and specifications have been prepared for the erection of a modern daylight plant of the best brick and mill type construction. The cost of the building will be in the neighborhood of half a million dollars. The main building will be 500 feet long and 80 feet wide. Upon completion three companies will commence operations in the buildings: Crouse-Hinds Company of Canada; Harvey-Hubbell, and the Hubbell-Mack Machine Screw Company. The new plant is not expected to commence operations until November 1, 1921.

Brantford Firm Changes.—The Brantford Machine & Tool Co., Ltd., has just been incorporated to continue and add to the former business of the Brantford Machine & Tool Co. Mr. Wm. J. Ham, a son of Mr. Jos. Ham, of Ham Brothers, has taken an interest in the concern and will take an active part therein. In addition to their old line of machine and machine tool work, they intend extending and manufacturing a line of garage equipment, such as bench presses, boring tools and small air compressors, and expect to find quite a ready market for same.

Canadian-Detroit Twist Drill.—The Detroit Twist Drill Company has announced the establishment of a manufacturing plant in Walkerville, Ontario, known as the Canadian-Detroit Twist Drill Company. The Detroit Company decided several months ago that the growth of Canadian industry warranted the construction of a plant across the border, and the new company was accordingly incorporated. High-speed drills and reamers will be manufactured and a complete stock will be built up as soon as possible. The nucleus of the Walkerville organization was formed from the personnel of the Detroit plant. About thirty men will be employed at the start. The officers and executives of the new company are as follows: President, Muir B. Snow; vice-president, Lewis H. Jones; treasurer, H. H. Sanger; secretary, P. C. Hill; manager, R. A. B. Goodman; superintendent, Geo. Johnston. Manufacturing operations have already begun, and the first drills are expected to be completed by November 15.

REPORT HAS IT THAT OIL IS TO BE FOUND IN HASTINGS COUNTY

BELLEVILLE.—Startling events of the past few days uncover the possibility of this section of Ontario becoming an important oil producing centre. In Tyendinaga Township, Hastings County, discoveries have been made which are very promising, and one of the largest companies in the world interested in development of oil properties is already in possession of options on over one thousand acres of land in that township. A farmer named Roach, living about three miles from Lonsdale, had a well which he couldn't use on account of the strong oil flavor, so he decided to drill another one. When down forty-two feet on the new well the rush of gas compelled suspension of operations, and there seemed more gas and oil than water. The farmer wanted water badly, but the recurrence of oil indications set him thinking. A relative from Pennsylvania, by profession an oil driller, had visited the farm a year or so ago, and noticing indications of oil, expressed great surprise that the oil scouts who cover the world looking for new fields had overlooked this locality. Mr. Roach came to Belleville and told Mr. John Elliott, manager of the Standard Bank, his story. Mr. Elliott at once communicated with his son-in-law, Mr. Reeves, travelling representative for the General Oil Fields, Limited, of London, England, who is spending a vacation in Belleville, having recently returned from Mexico. What Mr. Reeves saw convinced him that the prospects for an oil field here were excellent; in fact he states that indications are better than anything he saw in Mexico, one of the greatest oil countries in the world.

Mr. Reeves thinks so well of the property that he secured an option on over one thousand acres of land, including the Roach farm. If oil is discovered in quantity the farmers will be paid a good rental besides royalties, which means sudden fortune for a number of farmers in the vicinity of Marysville and Lonsdale.

Geologists have been sent for by Mr. Reeves and a thorough examination of the property will be made at once; if the property proves up as Mr. Reeves thinks it will, he thinks that his company will spend at least a million dollars in development within the next year.

SAY HELP IS NEEDED TO MAKE USE OF THE LOW-GRADE IRON ORES

FORT WILLIAM.—Presentations dealing with aid to the iron industries of this district in Ontario and a lengthy disposition of the doctrines of free trade occupied the time of the tariff commission here.

Sir Henry Drayton, chairman, Hon. G. D. Robertson and Hon. S. F. Tolmie were in attendance and the first witness was J. E. Marks of Port Arthur, who presented the case for the imposition of a bounty of at least 50 cents per ton upon iron ore mined in Ontario. He urged that the former bounties given for iron smelted from Canadian ores failed in their effect because they went to the smelter and not to the miner. He adduced figures in an effort to show that there were millions of tons of ore available close to railway and navigation facilities which required aid in order to be merchantable. He urged that the Dominion of Canada ought to cause the Canadian iron to be mined and utilized in Canadian furnaces.

The chairman asked whether he did not think that, with an apparent surplus of $100,000 the iron industry could not be trusted to take care of development without aid.

Mr. Marks replied that the raw material of the iron manufacturers was largely the half-finished product from the States.

To a remark by the chairman that the British Columbia bonus had apparently not been effective in building up iron industries, Mr. Marks said that the smelters got all the bonus and not the miner.

The chairman asked concerning the deleterious elements in the local iron ores and was told that the ores were free of all injurious elements except sulphur and this was disposed of by roasting, which was successfully done with the ore from the Atikokan range.

Dr. R. J. Manion, M.P., said that he had not intended to speak but he had advocated some form of aid to the iron industry on the floor of the House, and one reason that he would approve of the bounty was that if it was not earned by production the bounty would not be paid. He believed that Canada ought to produce many of the steel products which she now imports.

Owners of Iron Lands

J. J. O'Connor spoke as representative of owners of iron ore lands, and said that the time was coming soon when the lower grades of ore would be needed, and it was high time that Canada attempted to make use of her low grade ores. He pointed out that one American firm had spent $750,000 in experimenting with magnetic substances on the ranges in Minnesota and now began to install a three million dollar plant to utilize low grade iron ore.

Locomotive, Automobile, Aeroplane, Gun and Machine Parts

subject to maximum shocks of great frequency or torsional strains, are first forged. WHY? Because forging increases their physical properties, re-arranges the structure to withstand stresses in any desired direction, and gives each portion the required amount of working.

At the proper temperature the flutes of RICH TOOLS are first forged and twisted. The result is a blank thoroughly uniform in every part and of superior physical properties to the bar from which it was made.



NOT WELDED, BRAZED OR BUILT UP—MADE IN ONE PIECE of the most suitable and best High Speed Steel of the proper composition — every operation and process is conducted with care and judgment.

IT IS UNNECESSARY TO TELL YOU THAT THIS DRILL WILL PRODUCE MAXIMUM SERVICE—IT IS BUILT FOR IT.

Taper Shanks, Standard and Oversize. Straight Shank, Long and Short Set.

We also manufacture High Speed Bridge Reamers, Countersinks, Track and Bonding Bits, Rivet Sets, etc.

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Everything in Woodworking and Metalworking Machinery

If interested tear out this page and place with letters to be answered.

TO PROVIDE EDUCATION FOR THE OPERATING ENGINEERS IN ALBERTA

A DELEGATION from the steam Engineers in conference in Edmonton, consisting of E. E. Howard, Edmonton, F. J. Dobson, Edmonton, and W. G. Singer, Red Cliff, in the absence of the Minister met Mr. J. T. Ross, the Deputy Minister of Education, and D. A. Campbell, Provincial Director of Technical Education at the Department of Education, and pointed out the great need of providing instruction to the thousands of men in the province who have charge of boilers and engines in manufacturing and industrial establishments, in large business houses where elevators are used, in mining centres, in lumber mills, and in power plants.

It was pointed out that a technical knowledge of steam engineering, in addition to practical experience, is essential to the man in charge of such pivotal positions throughout the province. All are required to hold provincial certificates, and during the past two years the following numbers were issued by the Steam Boilers Branch of the Public Works Department, to men operating various types of portable and stationary boilers and engines.

	1918	1919
First class	6	4
Second class	26	18
Third class	135	142
Traction final	163	101
Firemans' final	55	45
Provisional	447	345
Renewals (Provisional)	177	209
	1,009	864

At the present time there are over two thousand five hundred portable and traction boilers in the province available for use, and the stationary boilers number seven hundred and forty, located in three hundred and thirty-six plants. All the men in charge of these boilers must be holders of provincial certificates obtained as the result of examinations, covering a wide range of practical scientific and technical knowledge.

The deputation was informed that the present policy of the department of education would assist the Steam Engineers in a manner similar to that in operation for the miners.

It was suggested that even classes for steam engineers might be organized at Edmonton, Calgary, Medicine Hat, Lethbridge, Red Cliff, Drumheller, and in the Crow's Nest Pass. These classes would be under the control of the local school boards. Provincial grants are already available, and will be paid to boards which conduct classes in these subjects.

The deputation was told that the department was aware that a real need existed and had announced steam engineering as a type of work which fell properly within the scope of the new provincial institute of technology and art at Calgary. The Steam Engineering department of this institute might undertake instruction by correspondence, to steam engineers located in all points in the province. The whole matter will be given further consideration upon the return from the east of the Hon. George P. Smith, Minister of Education.

The delegation left with the intention of taking advantage of the present provisions which enable school boards to supply this type of education in evening classes to adults.

The city of Lethbridge already has such a class organized.

BUSINESS OPPORTUNITIES

By communicating with this paper and mentioning key numbers, information can be obtained by firms interested in the following lines:

2035. MILD STEEL BOLTS AND NUTS.—Importers in Scotland are desirous of getting into touch with Canadian manufacturers of these in small sizes from ¼ in. thick up to ½ in.

2036. MACHINE TOOLS.—Engineering apparatus and tools, instruments for controlling heat treatment of metals, industrial machinery metals, special steels, electrical heating appartus, mica, etc. A most important limited company at Milan with very good business connections in Italy and abroad wishes to do business with Canada in the foregoing.

2045. A Trinidad commission agency wish to make connection with Canadian exporters of agricultural and artisans' tools.

2033. IRON AND STEEL BARS. — Firm in Scotland is open to receive quotations for the following: each five tons; iron or steel bars:
1½ x 1½ x ¼-ins. Angle x 20 to 21-ft.
2-in. x 2-in. x ¼-in. Angle x 20 to 21-ft.
3-in. x 3-in. x ¼-in. Angle x 18 to 20-ft.

2034. GALVANIZED SOLID WIRE AND BARBED WIRE.—Firm in Scotland is open to receive quotations for the following: 3 tons No. 6 galvanized solid wire; 3 tons No. 7 galvanized solid wire; 2 tons No. 8 galvanized solid wire; 4 tons galvanized barbed wire, 4 points 6-inch. apart.

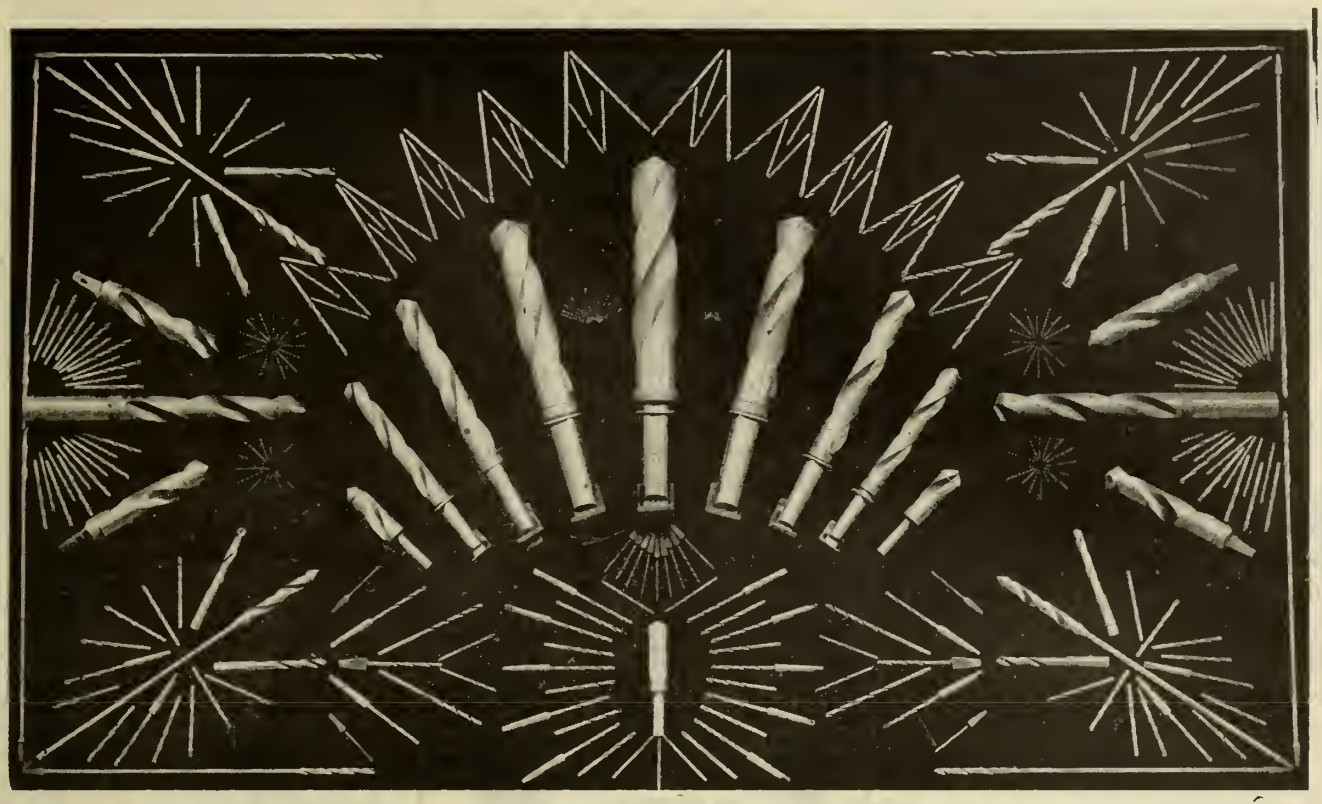
Starts British Branch—The Simonds Canada Saw Company, Limited, of Montreal, Quebec, have just secured a charter and established a new company in Great Britain, to be known as Simonds Saws, Limited. An office and shop has been opened at 53 Bayham, Camden Town, London, N.W. The shop will provide for maintenance and repairs of saws, machine knives, and other edge tools produced by the Simonds Company. Guy A. Eaves, formerly connected with the Fitchburg, Mass., plant of the company, has assumed the duties as office manager, and Leon E. Wilbur, who has covered the Great Britain territory since his discharge from the army in France, will be associated with him. The Simonds Manufacturing Company now maintains plants in Fitchburg, Mass., Chicago, Ill., Montreal, Canada, and a steel mill at Lockport N.Y.

STAINLESS OR RUSTLESS STEEL

Stainless or rustless steel consists essentially of an alloy of iron and chromium, containing usually 0.1-1 per cent. carbon and 12-14 per cent. chromium. It is produced in crucibles or electric furnaces, owing to the tendency of the chromium to oxidize at the melting point. The metal is cast in the usual manner into ingot molds, and the ingots are forged or rolled into bars or sheets. The material can be forged fairly readily into various forms if heated to a bright orange temperature; and if after forging the metal is allowed to cool in air, it will be found to possess good cutting qualities. Quenching in water enhances the hardness to a considerable degree, especially if the steel contains more than 0.4 per cent. carbon, but oil quenching gives the best results. This steel resists formation of scale during forging to a great extent, and is therefore adapted to high-temperature uses, such as engine valves, distilling apparatus, etc. When ground and polished the material resists tarnishing to a remarkable degree. It is slowly attacked by dilute or strong sulphuric and hydrochloric acids, practically unaffected by nitric acid, and is unaffected by nearly all the fruit acids and strong vinegar.

Automobile engineers in all parts of the world will await with keen interest the receipt of a report recently completed by the research committee of the Institution of Automobile Engineers of Great Britain. The report deals with the physical properties of the ten automobile steels standardized according to the recommendations of the British Engineering Standards Association. Colored charts will be given showing the result of tests of tensile strength, hardness, and other qualities as affected by heat treatment. Automobile construction is becoming more and more scientific every day, and it is evident that British designers intend to keep in the forefront of the advance which depends upon a minute knowledge of the materials employed. Only a limited number of reports will be printed and early application is therefore advised.

In advising an engineer as to the best means of treating an old oak staircase which had been attacked by woodworm, "The Builder" says that the most effective means of treating oak work when attacked with woodworm is to give it several coats of paraffin, well soaked into the wood. This should be done by a careful workman, making quite sure that every hole has been well soaked with the paraffin: if treated with paraffin it does not damage the oak, but has a tendency to improve the color.



Morrow Drills

Drills for Every Purpose

No matter what the drilling operation in your shop may be, you can get a MORROW DRILL to meet it—MORE HOLES with LESS RE-GRINDING.

John Morrow
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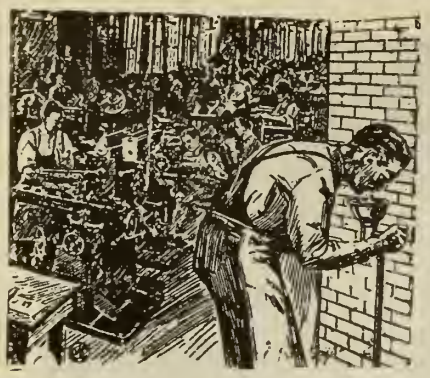
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What you pay for a few ordinary drinking cups will meet the cost of the

PURO SANITARY DRINKING FOUNTAIN

(MADE IN CANADA)

DRINKING CUPS ARE UNSANITARY but the "Puro" delivers clean, fresh water at a reduction of 15 per cent. to 35 per cent. in water bill.

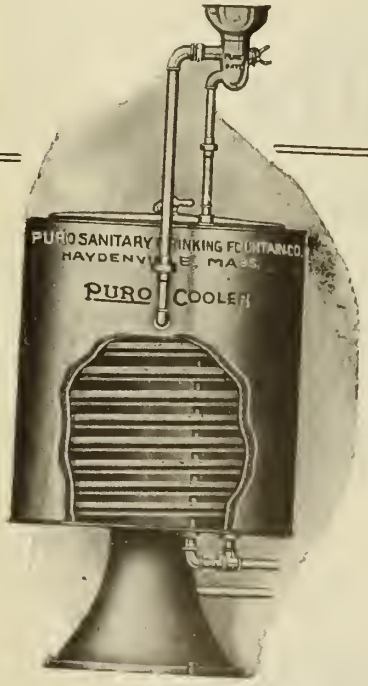
"PURO" WILL SAFEGUARD THE HEALTH OF YOUR EMPLOYEES and protect your staff against disorganization by sickness.

Easily attached. Simply unscrew the ordinary faucet and put on the "Puro."

Write us to-day for full information regarding the cost of installation of the "PURO" Sanitary Drinking Fountain Service.

Puro Sanitary Drinking Fountain Co.,

Canadian Agents:
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INDUSTRIAL FURNACES

Will Save 50% of the Fuel Used by Ordinary Furnaces

Double the capacity of your ordinary furnaces with the same oil consumption. This is a record that has been established by Oilgas Industrial Furnaces in many of Canada's prominent manufactories. There is an Oilgas Furnace for every process requiring heat. Investigate.

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We are equipped to fill the requirements of the Marine trade promptly. Square head, hexagon head and all kinds of Machine, Deck, Carriage Bolts and Rivets.

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LONDON BOLT & HINGE WORKS
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THE TUBE COMPANY OF CANADA LIMITED

Steel Tubing

for all purposes

Electric and Oxy-Acetylene Welded
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Butt Seam Tubing

Hot or cold rolled, in sizes ⅜ to 2 inches outside diameter, from 16 to 22-gauge.

We furnish any shape — Rounds, Squares, Hexagons, Ovals and Special Shapes to customers' specifications.

Expert advice given on all Steel Tubing Problems.

The Tube Company of Canada

233 Dufferin St. TORONTO, ONT

CALCULATING DIMENSIONS ON 100 H.P. H. R. T. BOILER

Continued from page 395

And for outer and middle rows

$$3\text{-}10P+d$$
$$=.3\times 6.68875+.875$$
$$=2.00625+.875$$
$$=2.881.$$

Of course these dimensions are all the minimum allowable, and if we exceed them it will not matter.

For the thickness of the metal forming the straps we have

$$\frac{5\times T\times(P-d)}{8\times(P-2d)} = \text{Thickness.}$$

Then

$$\frac{5\times 7(6\ 11\text{-}16-\frac{7}{8})}{8\times 16(6\ 11\text{-}16-7\text{-}4)}$$
$$=\frac{5\times 7\times 93\times 16}{8\times 16\times 16\times 79}$$
$$=.321 \text{ inches.}$$

This is practically 5-16, but it would be just as well to use ⅜ plate, and thus have a margin over size to allow for wasting, and to make a better caulking edge.

The dimensions for the joint will therefore be:

Pitch outside row, 6 11-16 inches.

Pitch inner rows, 3 11-32 inches.

Diameter of rivets, ⅞ inch.

Thickness of straps, ⅜ inch.

Minimum distance between outer and middle rows, 2.33 inches.

Minimum distance between inner and middle rows, 1.66 inches.

Minimum diagonal pitch between inner and middle rows, 2.35 inches.

Minimum diagonal pitch between outer and middle rows, 2.88 inches.

The width of straps will be the sum of the distance between the three rows of rivets, plus three diameters, multiplied by two.

The accompanying dimensioned sketch shows all the particulars.

Company Reorganized.—The reorganization of the Mami Axle Co., Ltd., St. Stephens, N.B., has just taken place. This is one of the oldest companies on the coast, and has been operating for about 25 years. The capital has been increased from $50,000 to $200,000, and it has been decided that they will rebuild the forge plant which was burned down last July. This building will be a modern forge plant with the purpose of making axes. It will be 60 ft. x 160 ft., and of steel and brick construction. A full line of equipment will be installed. The following are the new board of directors: Chas. E. Henstis, president; James Arnold, Brockville, vice-president, and J. A. Briggs, secretary-treasurer. The other gentlemen are: Hon. George P. Graham, Brockville; T. J. Dillon, and B. J. McCormack, of Welland.

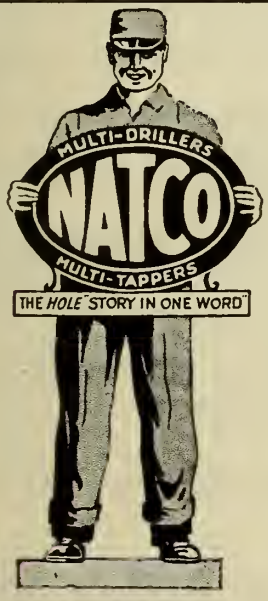
WILL IT WORK

Continued from page 397

fostered this chemical delusion and have educated the public to buy chemical analyses and test bar evidence; the public wanted it, and got it. The whole thing may be summed up in the following words: production, and still more production; composition, accurate to the dot, but quality be hanged. Craftsmanship and skill have given way to arbitrary formulae and the pseudo scientists are happy.

If the consumer will be guided by the question: "will it work?" he will devise simple, practical, sensible tests. He will employ practical, experienced inspectors. He will seek to test material for its suitability to the work at hand, and not merely for its composition.

In the series of articles to follow I will attempt to lay before our readers conditions in the metal world as they are and not how some people think they ought to be.



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NATIONAL AUTOMATIC TOOL CO.
Richmond, Indiana, U.S.A.

Special Machinery
MADE TO ORDER

Mill Machinery, Engine Work
Grey Iron and Brass Castings

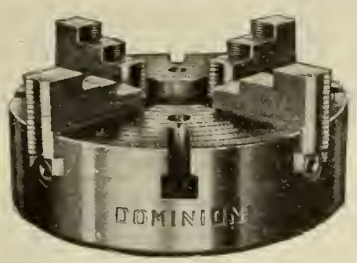
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ALEXANDER FLECK, LIMITED
(Vulcan Iron Works) OTTAWA, ONT.

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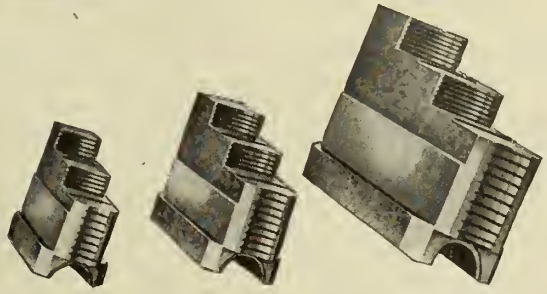
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THEY are drop forgings, made of best quality steel, heat-treated and hardened. The threaded portion of jaws form a half nut for the setting-up screws. Have stood the test of heavy duty work in our own shops where accuracy was the only accepted standard.

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Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters etc. Write for Booklet.
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Send us your blueprints and specifications. Entrust your requirements to experienced workmen and up-to-date equipment. Have your dies made in Canada. First-class workmanship guaranteed.
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Special styles of all kind to order.

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WANTED IMMEDIATELY—1 30-TON LUCAS Forcing Press. Address all replies to Box 722A, Canadian Machinery.

WANTED—FIVE TO SIX HUNDRED H.P. CORliss engine, also 72 in. roller-band resaw; 250 tons 40 or 50 ft. rails; 5-ton locomotive crane; all must be in good shape. Apply N. J. McArthur, 325 Howe St., Vancouver, B.C. (cfm)

WANTED—8 IN. HORIZONTAL, 54 IN. AND 66 in. upright band resaws; steam engines, 35 to 125 h.p.; 36 in. gang saw grinder, planers, edgers and sprocket chain, etc. R. C. Patterson, Smithville, Ont. (cfm)

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MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W. H. Sumbling Machinery Co., Toronto. (ctfm)

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6—No. 25 Foote Burt Drill presses, $250 each.
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1—No. 73½ Bliss Stamping Press, $500.
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All F.O.B. cars Lachine, Quebec, subject to prior sale.

Also Lathes of various kinds and a full line of used pulleys and hangers at very low prices.

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LIMITED
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1—16" Hendey Shaper
2—18" x 8' Mueller Lathes
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2— 3 x 36 J & L Turret Lathes.

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Machinery and Supplies
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LIVE BUSINESS MAN TO JOIN ANOTHER in the sale of high-grade electric trucks; clean-cut, profitable business, which will show large returns; this is an exceptional opportunity; executive and selling ability essential; also capital of $10,000; reply immediately. Box No. 720F, Canadian Machinery.

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Wanted, a jobber to represent, in Eastern Canada, an American manufacturer of well-known and advertised line of Oxy-Acetylene Welding and Cutting apparatus. Terms very favorable.

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Must be thoroughly familiar with the Foundry and Coal Mining Trade. Box 719 F, Canadian Machinery.

Mr. Charles L. Brown, titular to Canadian Patent No. 203,193, dated August 24th, 1920, relating to Improved Box Forming Machine (Wood), wishes to dispose of his inventor's rights and privileges. For information apply to: Adrian A. St. Laurent, Ind. Eng., Patent Broker, 75 Stewart, Ottawa, Ont. (C1SM)

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PORT ARTHUR, ONT.

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Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

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42" Pond Car Wheel Lathe, Motor Drive. 40 x 40 x 10' Powell, 2 H. Planer. No. 4 Brown & Sharpe Plain Miller, 3-Spindle Barnes B.G. Drill. Box 723F, Canadian Machinery.

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3 Phase, 60 Cycle, A.C., 110/150 Volts D.C.

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16½	MILWAUKEE-ALLIS-CHALMERS	1200	125
25	WESTINGHOUSE	850	150
35	GENERAL ELECTRIC	720	125
40	ALLIS-CHALMERS	850	120
50	GENERAL ELECTRIC	1200	125

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110/150 Volts

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At Extremely Low Prices

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Condition equal to new.
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7" Rhodes, Precision, new Shaper
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16" Used Kelley, B. G. Shaper
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No. 24 Osterlein, Plain Miller
No. 22 Garvin, Vertical Miller
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Also Manufacturers of "Adams Short-Cut Lathes"

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CANADIAN MACHINERY would like to see this Chart in every shop in the Dominion. Mail the coupon below for your copy to-day.

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Please send $\frac{me}{us}$ free, one of your tool grinding charts.

Signed .....

Firm Name .....

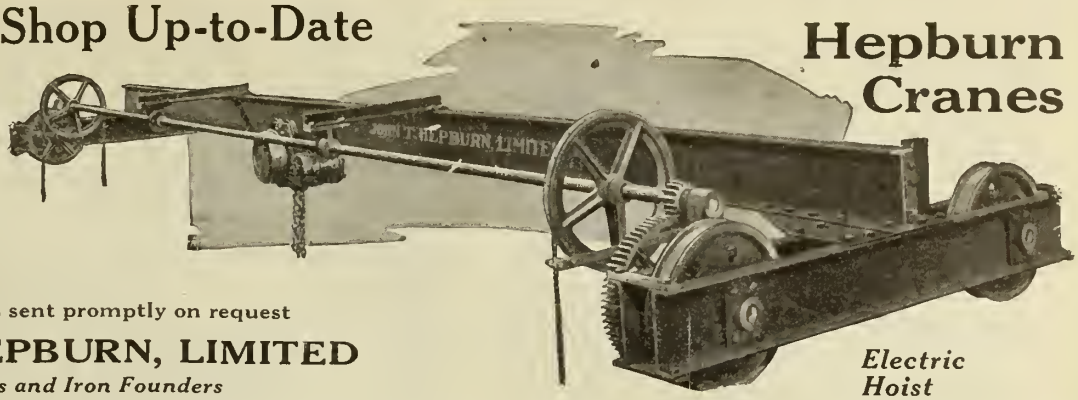
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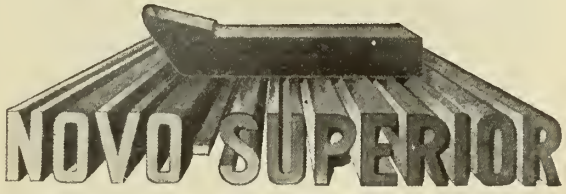
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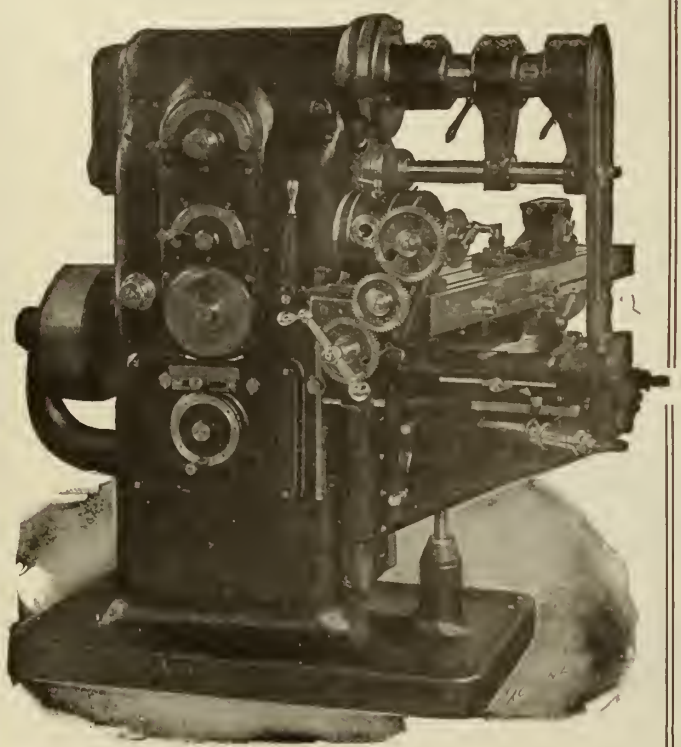
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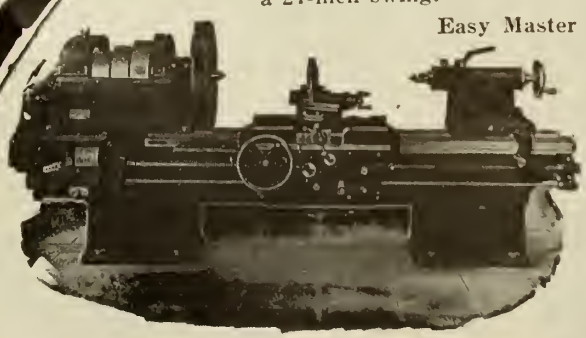
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Heavy Duty Lathes

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Easy Master of Big Jobs



Regardless of the severity of work, dependence put on Sidney Lathes has never been misplaced. The Sidney line has made good—with a vengeance. New Bulletin just issued on 25-inch machine. Write to-day!

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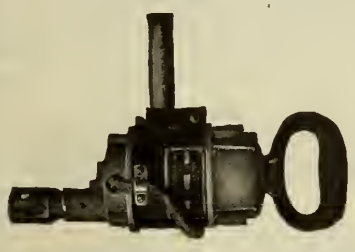
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They can be attached to any lamp socket.

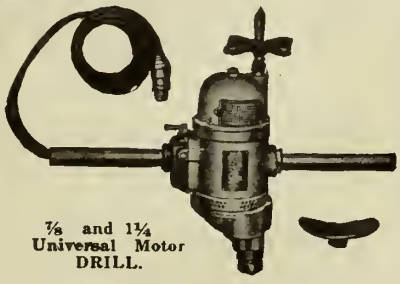
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All motors wound for 110 or 220 volts.

Direct or alternating current.

Try a few of our Electric Drills and Grinders and you'll send us an order for more. Our guarantee protects you.



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Pumps for pulp and paper mills, Pumping Engines for municipal purposes, Centrifugal Pumps.

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A universal grinder. A grinder with all attachments. A grinder that will handle all kinds of tool-sharpening as well as cylindrical, internal and surface grinding. An all-around machine for your tool-room.

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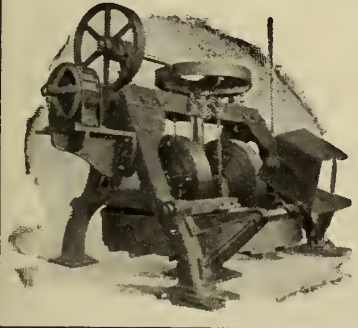
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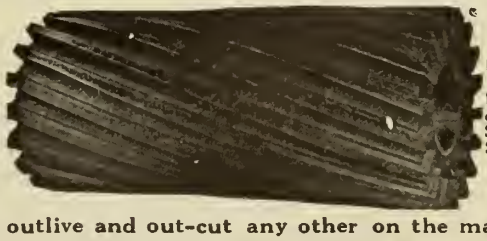
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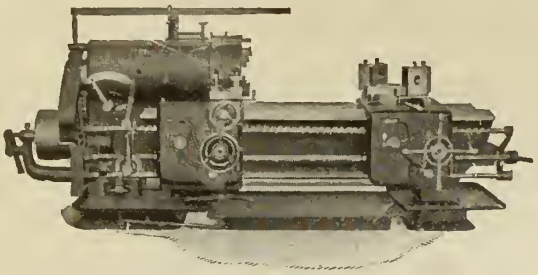
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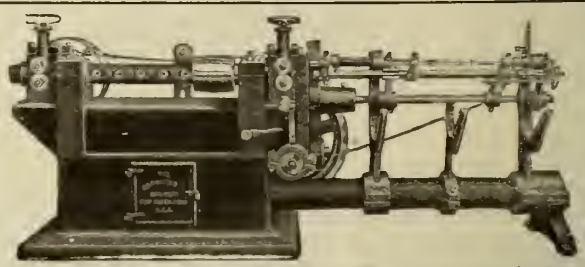
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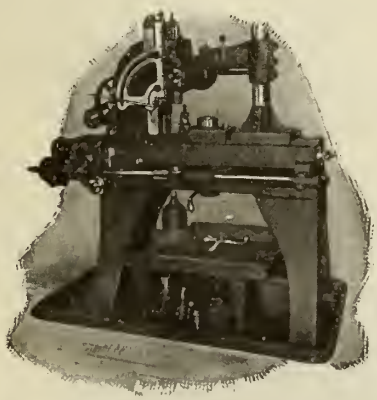
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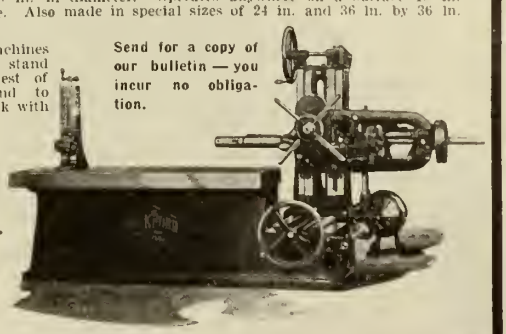
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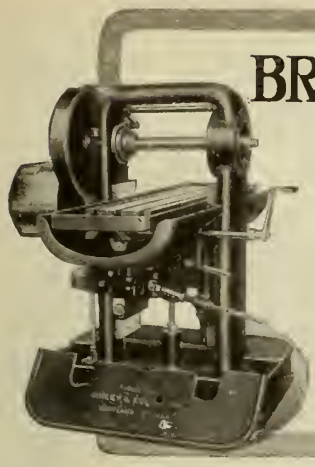
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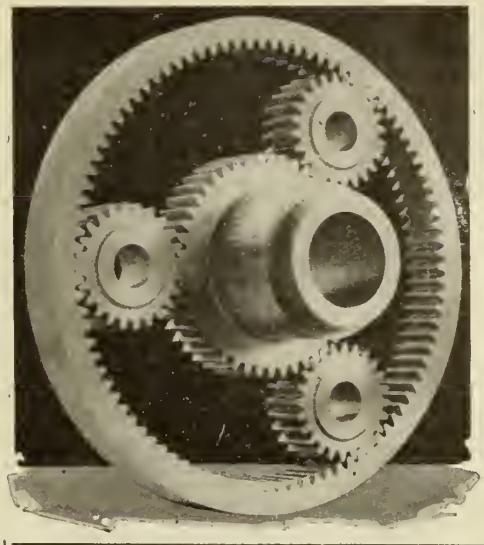
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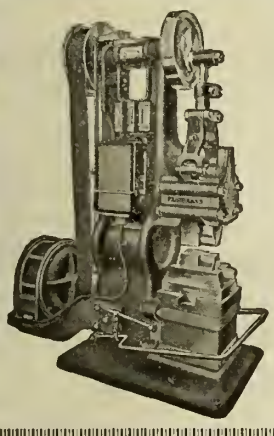
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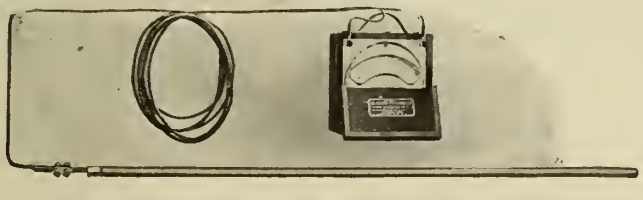
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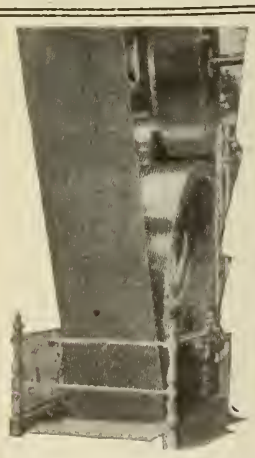
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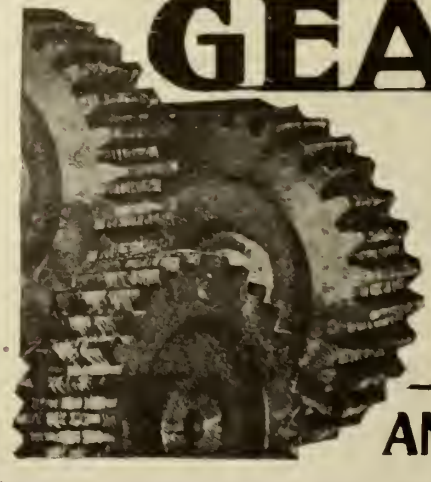
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Can. John Wood Mfg. Co., Ltd., Toronto.

BOILERS
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.

BOILERMAKERS' TOOLS
Holden & Co., Ltd., Montreal, Que.

BOLT CUTTERS AND NUT TAPERS
Aikenhead Hardware Co., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Landis Machine Co., Waynesboro, Pa.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOLTS
Aikenhead Hardware Co., Toronto, Ont.
London Bolt & Hinge Wks., London, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Rice, Lewis & Son, Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton
Wilkinson & Kompass, Hamilton, Ont.
Williams & Co., J. H., Brooklyn, N.Y

BOLTS, COUPLING
Galt Machine Screw Co., Ltd., Galt, Ont.

BOLTS, STAY
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, SPRING SHAKLE
Can. Winkley Co., Ltd., Windsor, Ont.
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, PATCH
Morrow Screw & Nut Co., John, Ingersoll

BOLT AND NUT MACHINERY
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Mchy Co., A. R., Toronto, Ont.

BOLT THREADING MACHINERY
Jardine & Co., Ltd., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

BONDING MACHINES (Electric Railway)
The Lincoln Electric Co., Toronto, Ont.

BORING MACHINES, PNEUMATIC CYLINDER
Cleveland Pneumatic Tool Co., Toronto.
Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto.

BORING MACHINES, UPRIGHT AND HORIZONTAL
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Herbert, Ltd., Alfred, Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Hoefer Mfg. Co., Freesport, Ill.
Landis Tool Co., Waynesboro, Pa.
Oliver Machinery Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Rockford Drilling Mchc. Co., Rockford, Ill.
Strelinger Chas. A. Co., Windsor, Ont.

BORING AND TURNING MILLS
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Foss Mch. & S'ply Co., Geo. F., Montreal
Herbert, Ltd., Alfred, Toronto, Ont.
Oliver Mach. Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.
Strelinger Chas. A. Co., Windsor, Ont.

BOXES, CAST IRON
Brown & Sharpe Mfg. Co., Providence, R.I.

BOXES, STEEL SHOP AND TOTE
Cleveland Wire Spring Co., Cleveland.

BARKES
Brown, Boggs & Co., Hamilton, Can.
Electric Steel & Metals, Ltd., Welland.

BRASS—SHEETS, ROLLS, PLATES, AND RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRASS ALLOYS
British Smelting & Refining Co., Ltd., Montreal, Que.

BRASS AND COPPER TUBING
Lyman Tube & Supply Co., Montreal, Que.

BRASS FOUNDERS
Canada Metal Co., Toronto.
Tallman Brass & Metal Co., Hamilton.

BRASS GOODS
Crane, Ltd., Montreal, Que.

BRASS PIPE AND TUBE
Crane, Ltd., Montreal, Que.

BRASS WORKING MACHINERY
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machinery Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Prest-O-Lite Co., Inc., Toronto, Ont.
Wood Turret Machine Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.
Brown's Copper and Brass Rolling Mills, New Toronto.

BRICKS, FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

BRIDGES, RLY. AND HIGHWAY
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

BROACHING MACHINES
Strelinger, Chas. A. Co., Windsor, Ont.

BRONZE—SHEETS, ROLLS, PLATES AND RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRONZE, NAVAL
Canada Metal Co., Toronto.

BRONZE COPPER
Tallman Brass and Metal Co., Hamilton.
Canada Metal Co., Toronto.

BRUSHES, CARBON
Lyman Tube & Supply Co., Montreal, Que.

BUFFING AND POLISHING MACHINERY
Ford-Smith Mach. Co., Hamilton.
Foss Mchy. & S'ply Co., Geo. F., Montreal
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BUCKETS, DUMP
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

BUCKETS, ELEVATOR
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

BUCKETS, CLAM SHELL, CRAB, DUMP
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Nortbern Crane Works, Ltd., Walkerville.

BULLDOZERS
Bertram & Sons Co., John, Dundas.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford
Garlock-Walker Machinery Co., Toronto.
Lourie Mfg. Co., Springfield, Ill.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

BURNERS, OIL AND NATURAL GAS
Northern Crane Works, Ltd., Walkerville.
W. S. Rockwell Co., New York, N.Y.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque.

BUSHING, BRONZE
Morrow Screw & Nut Co., John, Ingersoll

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CABLES, TRANSMISSION AND TELEPHONES
Northern Electric Co., Ltd., Montreal.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Carter Welding Co., Ltd., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Union Carbide Co., of Canada, Limited, Weland, Ont.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville.
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co., Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glasco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

CAR MOVERS
Holden Co., Ltd., Montreal, Que.

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Can. Metal Co., Toronto, Ont.

CASTINGS, DIE CAST
Can. Metal Co., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.
Fisher Motor Co., Ltd., Orilla, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

CASTINGS, STEEL—ALL KINDS
Canada Electric Castings, Ltd., Orilla, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co., Ltd., Orilla, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.

CARRIERS COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll.
Alexander Fleck Ltd., Ottawa.
Tallman Brass & Metal Co., Hamilton

CASTINGS, BENCH LEG
Brown & Sharpe Mfg. Co., Providence. R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt, Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown, Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co., Ltd., Orilla, Ont.
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
Interantional Malleable Iron Co., Guelpb
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.
McFarlane Engineering Ltd., G. W., Paris, Ont.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd., Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelpb

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Morrow Screw & Nut Co., J., Ingersoll.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machinery Co., Toronto.
Lyman Tube & Supply Co., Montreal, Q.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.
Renold of Canada, Ltd., Montreal.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Renold of Canada, Ltd., Montreal.
Williams Mchy. Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Can. Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N. Y.
Glasgow, N.S.
Renold of Canada, Ltd., Montreal.

CHAINS, SPROCKET WHEEL
Can. Link Belt Co., Ltd., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Ltd., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Labatory, Ltd., Toronto.

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, COLLET, AIR
Petrie, Ltd., H. W., Toronto.
Williams Mchy. Co., A. R., Toronto.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford
Foss Mchy. & Sply Co., Montreal.
Gardner, Robt. & Son, Montreal.
Garlock-Walker Machinery Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Herbert, Ltd., Alfred, Toronto, Ont.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Strelinger, Chas. A. Co., Windsor, Ont.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Warner & Swasey Co., Cleveland, O.
Williams Mchy. Co., A. R., Toronto, Ont.

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAY FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York, N.Y.

CLOCK SPRINGS
The Dunbar Brothers Co., Bristol, Conn

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.

CLOSETS
Crane, Ltd., Montreal, Que

CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

COAL CRUSHERS
Can. Link-Belt Co., Ltd., Toronto, Ont.

COAL HANDLING MACHINERY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Nova Scotia Steel & Coal Co., New

COLD ROLLED STRIP, ALL METAL COLLARS, SHAFTING
Can. Driver-Harris Co., Ltd., Walkerville.
Williams & Co., J. H., Brooklyn, N.Y.

COLLECTORS, PNEUMATIC
Can. Blower & Forge Co., Kitchener
Sturtevant Co., B. F., Galt, Ont.

COMPOSITION INGOT
Canada Metal Co., Toronto.

COMPOUNDS, CUTTING AND GRINDING, DRAWING STAMPING
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR
Atkins & Co., E. C., Hamilton, Ont.
Can. Ingersoll-Rand Co., Sherbrooke.
Cleveland Pneumatic Tool Co., Toronto
Curtis Pneumatic Machy. Co., St. Louis
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Superior Machinery Co., London, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CONDENSERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
MacGovern & Co., Montreal, Que.

CONDUITS
Northern Electric Co., Ltd., Montreal, Que.

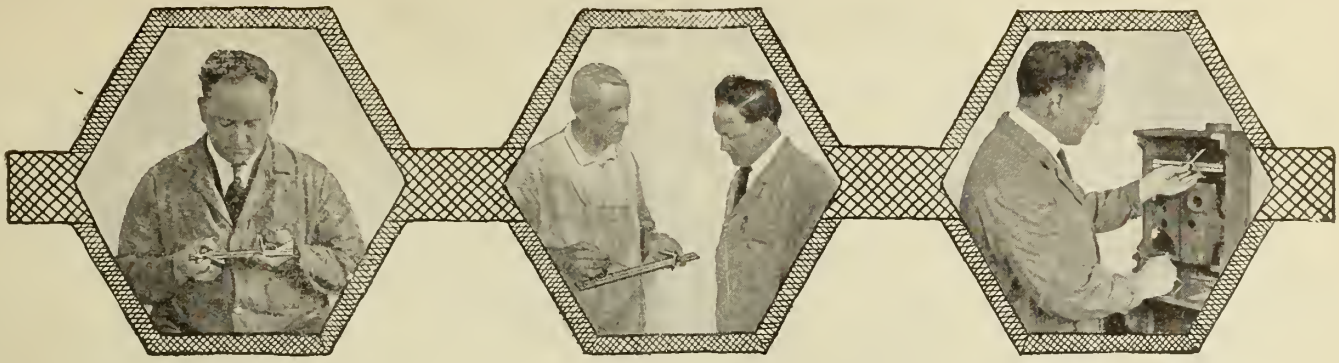
CONNECTING RODS
Canada Found's & Forgings, Ltd., Welland, Ont.

CONNECTING ROD CUTTERS INTERCHANGEABLE
Eclipse Counter bore Co., Ltd., Walkerville, Ont.

CONTRACT WORK
Brown Engineering Corp., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
Globe Engineering Co., Hamilton, Ont.
Katie Foundry, Ltd., Galt, Ont.
Victoria Foundry Co., Ottawa.

CONTROLLERS, MAGNETIC BRAKES, ELECTRIC WINCHES, MONO RAIL HOISTS
Volta Mfg. Co., Welland, Ont.

CONTROLLERS AND STARTERS
Williams Mach'y. Co., A. R., Toronto



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Providence, R. I., U. S. A.

Canadian Representatives:
The Canadian Fairbanks-Morse Co., Limited

B·S
TRADE MARK

If interested tear out this page and place with letters to be answered.

CONTROLLING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

CONVERTERS, ROTARY
MacGovern & Co., Montreal, Que.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.

COOLERS, WITH DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co. Haydenville, Mass.

COPING MACHINES
Bertram & Sons Co., John, Dundas, Ont.
Dom. Steel Products Co., Ltd., Brantford
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Can. Blower & Forge Co., Kitchener.

COPPER, BUS BAR, SHEET, PLATES, RODS
British Smelting & Refuing Co., Ltd., Montreal, Que.
Brown's Copper and Brass Rolling Mills, New Toronto.

CORE OIL
Swan & Finch, Inc., 165 Broadway.

COUNTERBORES AND COUNTERSINKS
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.

COUNTERSINKS, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

COUNTERBORES, INVERTED, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

COUNTERSHAFTS
Almond Mfg. Co., Ashburnham, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Baird Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., Ltd., A. R., Montreal
Williams Mchy Co., A. R., Toronto.

COUPLINGS, FRICTION
Bernard Industrial Co., The A., Fortierville, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto.

COUPLINGS, RAPID HOSE
Ont. Machinery & Supply Co., Ltd., Montreal, Que.

COILING MACHINERY, WIRE AND SPRING
Garlock-Walker Machinery Co., Toronto.

BUCKET
Hanna & Co., M. A., Cleveland, O.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Cleveland Pneumatic Tool Co. of Canada, Toronto.

CRANES, OVERHEAD, HAND AND
Gardner, Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Northern Crane Works, Walkerville.

ELECTRIC
Volta Manufacturing Co., Welland, Ont.

CUPS, OIL
Can. Winkley Co., Ltd., Windsor, Ont.

COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.

CRANES, GRAVITY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

CRANE RUNWAYS
MacKinnon Steel Co., Sherbrooke, Que.

CRANES, JIB
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, LOCOMOTIVE
Brown Hoisting Machinery Co., Cleveland, Ohio.
Holden Co., Ltd., Montreal, Que.

CRANES, GOLLIATH, PNEUMATIC AND PORTABLE
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane and Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Petrie, Ltd., H. W., Toronto.

CRANES, PILLAR
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls; Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy. Co., A. R. Toronto, Ont.

CRANES, TRAVELLING, ELECTRIC AND HAND POWER
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Oliver Engineering Co., Montreal.

CRANK SHAFTS
Can. Found'n & Forgings Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.

CRANK PIN TURNING MACHINE
Herbert, Ltd., Alfred, Toronto, Ont.

CRIMPS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass.

CRUSHERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.

CUPOLAS
Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.

CURB PUMPS FOR OIL, GASOLINE
Bowser Co. Ltd. S. F., Toronto, Ont

CURRENT TRANSFORMERS
Volta Manufacturing Co., Welland, Ont

CUT-OFF COUPLINGS, FRICTION
Petrie, Ltd., H. W., Toronto.

CUTTERS, BOLT
See Bolt Cutters.

CUTTERS, GEARS
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto

CUTTER HEADS
Oliver Machinery Co., Grand Rapids, Mich.

CUTTERS, PIPE (See Pipe Cutters)

CUTTERS, HIGH SPEED
Madison Mfg. Co., Madison, Wis.

CUTTERS, MILLING
Butterfield & Co., Rock Island, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Sply. Co., G. F., Montreal.
Garvin Machine Co., New York.
Ingersoll Mache. Co., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg. Co., Hartford Conn.
Wilt Twist Drill Co., Walkerville, Ont

CUTTER RELIEVING MACHINES
Cleveland Milling Machine Co., Cleveland

CUTTING-OFF MACHINES
Armstrong Bros., Tool Co., Chicago.
Atkins & Co., E. C., Hamilton, Ont.
Bertram & Sons Co., John, Dundas.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
G. F. Foss Mchy. & Sply. Co., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass.
Kennedy & Sons, Wm., Owen Sound
Lyman Tube & Supply Co., Montreal, Que.
Niles-Rement-Pond Co., New York.
Prest-O-Lite Co., Inc., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Tabor Mfg. Co. Philadelphia, Pa.
Williams Tool Corp. of Canada, Ltd., Brantford, Ont.
Wells Bros., of Can., Galt, Ont.
Williams Mchy. Co., A. R., Toronto, Ont.

CUTTING COMPOUND AND CUTTING OIL
Cataract Refining Co., Ltd., Toronto
Swan & Finch, Inc., New York.

CUTTING OIL, RECLAIMING SYSTEM
Bowser Co., Ltd. S. F., Toronto, Ont.

CUTTING AND WELDING PLANTS
Davis-Bournonville Co., Jersey City, N.J.
Prest-O-Lite Co., Inc., Toronto, Ont.

CYANIDE AND LEAD BATH POTS
Swedish Crucible Steel Co., Windsor.

CYLINDERS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton, Ont.

REHUMIDIFYING
B. F. Sturtevant Co. Galt, Ont.

DERRICKS
Aikenhead Hardware Co., Toronto, Ont.
Dominion Bridge Co., Montreal.
Hepburn Co., Ltd., J. T., Toronto, Ont.
Morris Crane & Hoist Co., Sherbrook.

DIAMOND (BORTZ)
Furniss, Clarke & Co., Montreal, Que.

DIAMOND TOOLS
Can. Desmond-Stephan Mfg. Co., Hamilton.
Ford-Smith Machine Co., Hamilton, Ont.
Furniss Clark & Co., Montreal, Que.
Joyce-Koebel Co., Inc., New York City
Wheel Trueing Tool Co., Detroit.
Petrie Ltd., H. W., Toronto.

DIAMONDS, CARBON AND BORTZ
Joyce Koebel Co., Inc., New York, N.Y.
Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.

DIE CASTINGS
Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

DIE HEADS, AUTOMATIC
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

DIES FOR BIT BRACE USE
Butterfield & Co., Rock Island, Que.
Crescent Mche, Co., Ltd., Montreal, P.Q.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Wells Brothers Co., of Canada, Galt.

DIES AND DIE STOCKS
Ackworthie Ltd., J., Birmingham, Eng.
Aikenhead Hardware Co., Toronto, Ont
Atkins & Co., Ltd., Wm., Sheffield, Eng
Butterfield & Co., Rock Island, Que.
Brown, Boggs Co., Hamilton, Ont.
Crescent Mche, Co., Ltd., Montreal, P.Q
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
Herbert Ltd., Alfred, Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Jones & Lamson, Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Brothers of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DIES, HAMMERED
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, DROP FORGE.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, METAL STAMPING
Ackworthie Ltd., J., Birmingham, Eng.
Crescent Mche. Co., Ltd., Montreal, P.Q
Elliott & Whitehall, Galt, Ont.

DIES, PIPE THREADING
Ackworthie Ltd., J., Birmingham, Eng.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Crescent Mche, Co., Ltd., Montreal, P.Q.
Landis Machine Co., Waynesboro, Pa.

DIES, THREADING
Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Crescent Machine Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros. of Can., Galt, Ont.

DIE SINKERS
Ackworthie Ltd., J., Birmingham, Eng.
Garvin Machine Co., New York.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.
Pratt & Whitney Co., Dundas, Ont.
Walcott Lathe Co., Jackson, Mich

DIES FOR MACHINES
Ackworthie Ltd., J., Birmingham, Eng.
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que.
Landis Machine Co., Waynesboro, Pa
Wells Brothers Co. of Canada, Galt.

DIE HEADS
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros. of Canada, Galt, Ont.

DIES, SELF-OPENING
Geometric Tool Co., New Haven.
Herbert, Ltd., Alfred, Toronto, Ont.
Landis Machine Co., Waynesboro, Pa
Murchey Machine & Tool Co., Detroit
Wells Brothers Co. of Can., Galt, Ont
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.

DIE FILING MACHINES
Oliver Mach. Co., Grand Rapids, Mich

DIE STEEL, HOT AND COLD WORK
Armstrong-Whitworth of Can., Montreal
Atkins & Co., Ltd., Wm., Sheffield, Eng
Marshall, Son & Bunney, Toronto.
Firth & Sons, Thos., Montreal, Que.

DIES FOR SCREW PLATES
Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Wells Bros. Co. of Can., Galt, Ont.

DIES, SHEET METAL WORKING
Ackworthie Ltd., J., Birmingham, Eng.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Globe Engineering Co., Hamilton, On
Stoll Co., D. H., Buffalo, N.Y.

DIES, SCREW AND THREAD
Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros., Co., of Can., Galt, Ont

DISCS, LEATHER, STEEL
Graton & Knight Mfg. Co., Worcester, Mass.

DIRECT CONNECTED UNITS
MacGovern & Co., Montreal, Que.

DRAFT, MECHANICAL
Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sturtevant Co., B. F., Galt, Ont.

DRAINAGE FITTINGS
Crane, Ltd., Montreal, Que.

DRAWING INSTRUMENTS
Hughes, Owens Co., Ltd., Montreal, Que.

DRAWING OFFICE SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

DRESSERS, GRINDING AND EMERY WHEEL
Atkins & Co., E. C., Hamilton, Ont.
Can. Desmond-Stephan Mfg. Co., Hamilton
Dominion Abrasive Co., Ltd., Mimico, On
Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont

DRILL PRESSES
Can. Blower & Forge Co., Kitchener.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
U. S. Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto

DRILL RODS
Atkins & Co., Ltd., Wm., Sheffield, Eng
Lincoln Electric Co. of Canada, Ltd Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Swedish Steel & Importing Co., Ltd Montreal.

DRILLING MACHINES, GANG
Bilton Mach. Tool Co., Bridgeport, Conn
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Silver Mfg. Co., Salem, Ohio.
Strelinger, Chas. A. Co., Windsor, Ont.

DRILLING MACHINES, LOCOMOTIVE AND MULTIPLE SPINDLE
John Bertram & Sons Co., Dundas.
Bilton Mach. Tool Co., Bridgeport, Conn
Can. Blower & Forge Co., Kitchener, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Mach. Co., Toronto.
Garvin Machine Co., New York.
Hoefer Mfg. Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
Nat. Automatic Tool Co., Richmond, Ind
Niles-Bement-Pond Co., New York.
Rockford Drilling Mach Co., Rockford, Ill
Strelinger, Chas. A. Co., Windsor, Ont.

DRILLING MACHINES, RADIAL AND TURRET
John Bertram & Sons Co., Dundas.
Canadian Fairbanks-Morse Co., Montreal
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Herbert, Ltd., Alfred, Toronto, Ont.
Henry & Wright Mfg. Co., Hartford.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont

DRILLING MACHINES, SENSITIVE
Bilton Mach. Tool Co., Bridgeport, Conn
Canadian Fairbanks-Morse Co., Montreal
Canadian Machinery Corp., Galt, Ont.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Mach. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn
Herbert, Ltd., Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
United States Mach. Tool Co., Cincinnati
Williams Mchy Co., A. R., Toronto, Ont.

DRILLING MACHINES, UPRIGHT AND HORIZONTAL
John Bertram & Sons Co., Dundas.
Garlock-Walker Mach. Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.
Canada Mach. Corp., Galt, Ont.
Garvin Machine Co., New York.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mach. Co., Toronto, Ont
Herbert, Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Nat. Automatic Tool Co., Richmond, Ind
Rockford Drilling Mach. Co., Rockford, Ill
Niles-Bement-Pond Co., New York.

To the Man With an Industry to Locate



The City of St. Johns Quebec

Deserves Your First Consideration

ITS LOCATION on the Richelieu River (27 miles from Montreal) provides the city with a direct water route to the Eastern Seaboard of the United States and the Great Lakes. Its commanding position in relation to the important markets of Canada and the United States assures economy and dispatch in the assembling of raw materials and distribution of the finished product.

POWER. A plentiful supply of power is developed at Chambly, eleven miles north-east of the city and distributed in St. Johns at rates that will compete with any city or town in Canada. Excellent railway connections assure a satisfactory coal supply.

TRANSPORTATION. Seven railroads, including Canada's two great transcontinental lines, run through the city. St. Johns obtains lower freight rates than any other centrally-located point on the continent.

LABOUR. St. Johns is known as the cheapest labour market in Canada. Skilled and unskilled labour is always plentiful and labour troubles are unknown.

In addition to the natural advantages of St. Johns as a location for a new industry the city greatly reduces the initial expense and difficulties of organization by granting many extraordinary inducements and concessions.

For More Detailed Information Write

The Secretary of the City Council

St. Johns, Quebec, Canada

If interested tear out this page and place with letters to be answered.

Silver Mfg. Co., Salem, Ohio.
Strelinger, Chas. A. Co., Windsor, Ont.
A. R. Williams Machinery Co., Toronto

DRILLING MACHINES, SPECIAL
Hoefer Mfg. Co., Freeport, Ill.

DRILLING POSTS
Aikenhead Hardware Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Silver Mfg. Co., Salem, Ohio.

DRILLS, BENCH
Aikenhead Hardware Co., Toronto.
Can. Blower & Forge Co., Kitchener.
Can. Fairbanks-Morse Co., Montreal.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Machinery Co., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

DRILLS, BLACKSMITH AND BIT STOCK
Aikenhead Hardware Co., Toronto, Ont
Butterfield & Co., Inc., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
Cleveland Twist Drill Co., Cleveland.
Geo. F. Foss Mch. & S'ply Co., Montreal
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Can., Walkerville

DRILLS, CENTRE
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilt Twist Drill Co., of Can., Walkerville

DRILLS CORE, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

DRILLS, CARBON
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
John Morrow Screw & Nut Co., Ingersoll

DRILLS, ELECTRIC, CORNER
Holden Co., Ltd., Montreal, Que.

DRILLS, ELECTRIC, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
Cincinnati Electrical Tool Co., Cincinnati
Geo. F. Foss Mch. & S'ply Co., Montreal
Hanlon Co., R. C., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pilot Steel & Tool Co., Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
Strelinger Co., C. A., Windsor, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
A. R. Williams Mach. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto. Ont.

DRILLS, HAMMER
Samuel Osborne, Ltd., Montreal, P.Q.

DRILLS, EMERY
Garlock-Walker Mach. Co., Toronto, Ont.

DRILLS, HIGH SPEED TWIST
Aikenhead Hardware Co., Toronto, Ont.
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal
H. A. Drury Co., Montreal.
Geo. F. Foss Mch. & S'ply Co. Montreal
Herbert, Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Osborne, Samuel, Montreal, P.Q.
Pratt & Whitney Co., Dundas, Ont.
Petrie, H. W. Toronto.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Strelinger Co., Chas. A., Windsor, Ont.
Taylor J. A. M., Stair Bldg., Toronto.
Wilt Twist Drill Co. of Can., Walkerville
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, OIL TUBE
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

DRILLS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Williams Mchy Co, Ltd., A. R., Montreal
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, PNEUMATIC CORNER
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Chicago.

DRILLS, RATCHET AND HAND
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

DRILLS, ROCK
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
The Foss Mchy. & Supply Co., Montreal.
Holden Co., Ltd., Montreal, Que.
Samuel Osborne Ltd., Montreal, P.Q.
Strelinger, Chas. A. Co., Windsor, Ont.
A. R. Williams Machy. Co., Toronto.

DRILLS, SQUARE & HEXAGON
Globe Engineering Co.

DRILLS, TRACK
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Holden Co., Ltd., Montreal, Que.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

DRINKING FOUNTAINS, SANITARY
Crane, Ltd., Montreal, Que.
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

DRIVES, CHAIN
See Belting, Chain.

DRIVING TOOLS
The Thos. Pink Co., Ltd., Pembroke, Ont.

DRY CLEANING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

DRYERS, SAND
Lyman Tube & Supply Co., Montreal, Que.

DRYING APPLIANCES
Baird Machine Co., Bridgeport, Conn.
Sturtevant Co., B. F., Galt, Ont.
W. S. Rockwell Co., New York, N.Y.

DRUM CONTROLS
Volta Manufacturing Co., Welland, Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.

DUST HANDLING EQUIPMENT
Sturtevant Co., B. F., Galt, Ont.

DUST SEPARATORS
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

DYNAMOS AND ELECTRICAL SUPPLIES
Canadian Fairbanks-Morse Co., Montreal.
MacGovern & Co., Montreal, Que.
Strelinger Co., Chas. A., Windsor, Ont.
A. R. Williams Machy. Co., Toronto.

ELECTRICAL SUPPLIES
Lyman Tube & Supply Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal Que

ELECTRIC FURNACES
Electric Furnace Construction Co., Philadelpria, Pa.
Volta Manufacturing Co., Welland, Ont.

ELECTRIC FURNACE REGULATORS, WINCHES, ROOF COOLERS AND ELECTRODE HOLDERS
Volta Manufacturing Co., Welland, Ont.

ELECTRIC HOISTS, STATIONARY AND MONO RAIL
Canadian Link-Belt Co., Ltd., Toronto,
Volta Manufacturing Co., Welland, Ont.

ELECTRIC MOTORS
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
Volta Manufacturing Co., Welland, Ont.

ELECTRIC TRUCKS
Cowan Truck Co., Holyoke, Mass.

ELEVATOR, ENCLOSURES
Volta Mfg. Co., Welland, Ont.
Canada Wire & Iron Goods Co., Hamilton

ELEVATOR WEIGHTS
Katie Foundry, Galt, Ont.

ELEVATORS AND BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.

ELEVATING AND CONVEYING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Petrie, Ltd., H. W., Toronto.

EMBOSSING PRESSES
Dom. Steel Products Co., Ltd., Brantford.
Oliver Machinery Co., Grand Rapids, Mich

EMERY GRINDERS (PNEUMATIC)
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.

EMERY CLOTH
Atkins & Co., E. C., Hamilton, Ont.

EMERY PAPER
Atkins & Co., E. C., Hamilton, Ont.

EMERY AND EMERY WHEELS
Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford, Canada.
The Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.

EMERY WHEEL DRESSINGS
Dominion Abrasive Co., Ltd. Mimico, Ont.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Wheel Truing Tool Co., Windsor Ont.

ENAMELWARE
Crane, Ltd., Montreal, Que.

END MILLS
John Morrow Screw & Nut Co., Ingersoll

ENGINEERS—INDUSTRIAL CLEANING (Free Consultation)
Oakley Chemical Co., New York, N.Y.

ENGINEERS
Samuel Osborne (Canada) Ltd., Montreal.

ENGINES, STEAM, GAS, GASOLINE
Furniss, Clarke & Co., Montreal, Que
Canadian Fairbanks-Morse Co., Montreal.
Holden Co., Ltd., Montreal, Que.
Johnson Mach. Co., Carlyle, Manchester, Conn.
MacGovern & Co., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

ENGINES, HORIZONTAL AND VERTICAL
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Johnson Mach. Co., Carlyle, Manchester, Conn.
Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

ENGINES, OIL
Holden Co., Ltd., Montreal, Que.
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.

ENGINES, HEAVY OIL, DIESEL TYPE
Dom. Steel Products Co., Ltd., Brantford
Holden Co., Ltd., Montreal, Que.

ENGINES, MARINE
Can. Ingersoll-Rand Co., Sherbrooke, Que
Sturtevant Co., B. F., Galt, Ont.

ENGINES, STATIONARY, FUEL OIL, GAS OR GASOLINE
Holden Co., Ltd., Montreal, Que.

ESCUTCHEON PINS
Parmenter & Bulloch, Gananoque, Ont.

EXHAUST HEADS AND HOODS
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co. Montreal.
Sturtevant Co., B. F., Galt, Ont.

EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
Can. Driver-Harris Co., Walkerville, Ont.

EXTRACTORS, TAP
Walton Co., The, Hartford, Conn.

EYE BOLTS AND NUTS
Can. Foundries & Forgings, Ltd., Welland, Ont.

EYE PROTECTORS
Standard Optical Co., Geneva, N.Y.

FACTORY LOCATIONS
City of St. Johns, Quebec.

FACTORY SITES
City of St. Johns, Quebec.

FANS
Baird Machine Co., Bridgeport, Conn
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

FENCE, IRON AND FACTORY
Can. Wire & Iron Goods, Hamilton, Ont.

FERRO-TUNGSTEN
Vanadium-Alloys Steel Co., Pittsburgh, Pa

FIBRE, RODS AND SHEETS
Diamond State Fibre Co., Bridgeport Pa.

FILES
Aikenhead Hardware Co., Toronto, Ont
Atkins & Co., Wm., Sheffield, Eng.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Marshall, Son & Bunney, Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.

FILES, COMMUTATOR SLOTTING
Lyman Tube & Supply Co., Montreal, Que.

FILING MACHINES, BENCH AND MOTOR DRIVEN
Cochrane-Bly Co., Rochester, N.Y., U.S.A

FILTERING AND CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. Wire & Iron Goods, Hamilton, Ont.

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Elk Fire Brick Co., Hamilton, Ont.
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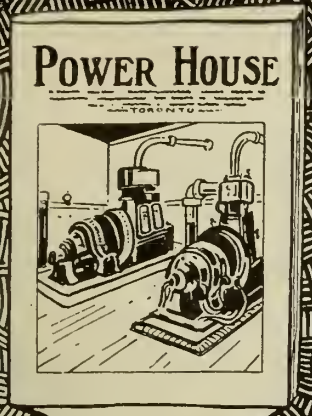
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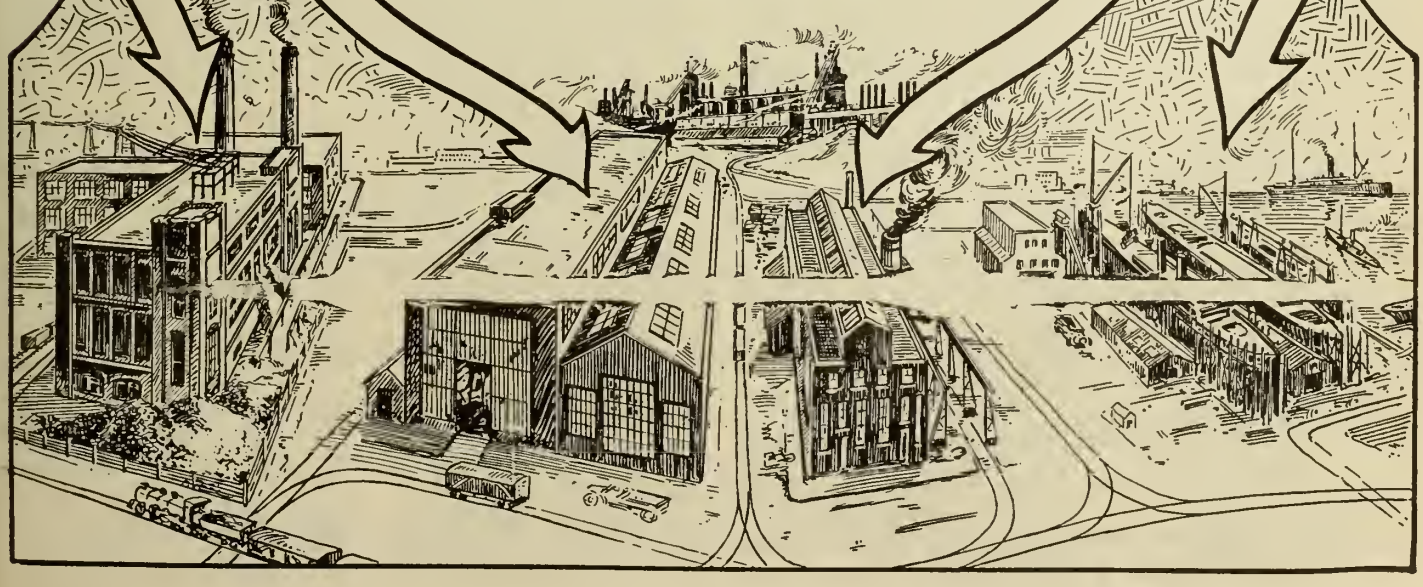
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Clipper Belt Lacer Co., Grand Rapids.

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MacKinnon Steel Co., Ltd., Sherbrooke.
Dominion Bridge Co., Montreal, Que.
William Hamilton Co., Peterboro, Ont.
Toronto Iron Works, Ltd., Toronto, Ont.

HOSE, FIRE PROTECTION
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal

HOSE, PNEUMATIC
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Independent Pneumatic Tool Co., Chicago.
Quaker City Rubber Co., Philadelphia, Pa.
Wells Bros. Co. of Canada, Galt, Ont.

HOSE, ALL KINDS
Goodyear Tire & Rubber Co., of Canada, L..., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HOSE, SAND BLAST
Goodyear Tire & Rubber Co. of Can., Ltd. Toronto
Quaker City Rubber Co., Philadelphia, Pa.

HOSE, STEAM, SUCTION AND WATER
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HUMIDIFIERS
Sturtevant Co., B. F., Galt, Ont.

HYDRAULIC ACCUMULATORS
Dom. Steel Products Co., Ltd., Brantford.

HYDRAULIC MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford.
Eastern Production Co., Detroit, Mich.
Garlock-Walker Machinery Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Victoria Foundry Co., Ottawa.

HYDRAULIC TURBINES
Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

HYDROMETERS, HYGROMETERS, HYGRODRIKS
Taylor Instrument Co., Rochester, N.Y.

INDICATORS, SPEED
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

INDEX CENTRES
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Petrie, Ltd., H. W., Toronto.

INDICATING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y

INDUSTRIAL SITES
City of St. Johns, Quebec.

INGOTS, FORGING AND ROLLING
Electric Steel & Metals Co., Welland.

INSULATING COMPOUNDS
Robertson Co., Ltd., H. H., Sarnia, Ont.

IRON ORE
Hanna & Co., M. A. Cleveland, O.

IRON, WROUGHT, ROLLED, PIG
Swedish Steel & Impt. Co., Ltd., Montreal

JACKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
...dge Engineering Co.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.

JACKS, PIT AND TRACK
Canadian Fairbanks-Morse Co., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Northern Crane Works, Walkerville.

JAWS, FACE PLATE
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford
Sammet Chuck Co., New Britain, Conn

JIGS, TOOLS, ETC.
Ackworthne Ltd., J., Birmingham, Eng.
Brown Engineering Corp., Toronto
Crescent Mach. Co., Ltd., Montreal, P.Q.
Fishcit Machine Co., Madison, Wis.
Globe Engineering Co., Ltd., Hamilton.
Jones & Lamson, Springfield, Vt.

JOURNAL WEDGES
Canada Foundries & Forgings, Welland.
Dominion Foundries & Steel Ltd., Hamilton, Ont.

KEY SEATERS
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, M.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Machy. Co., A. R., Toronto.

KEYS, MACHINE
Williams & Co., J. H., Brooklyn, N.Y.

KILNS
Can. Blower & Forge Co., Kitchener, Ont.
General Combustion Co., Ltd., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

KNIVES, MACHINE
Atkins & Co., E. C., Hamilton, Ont.

LABORATORIES, INSPECTION AND TESTING (see Chemists)

LADLES, FOUNDRY
Northern Crane Works, Walkerville.

LACING MACHINES
Clipper Belt Lacer Co., Grand Rapids, M.

LAG SCREW GIMLET POINTERS
National Machy. Co., Tiffin, Ohio.

LATH
Robertson, Ltd., H. H., Sarnia, Ont.

LATHES, CHUCKING
Acme Machine Tool Co., Cincinnati, Ohio.
Petrie, Ltd., H. W., Toronto.

LATHE CHUCKS (See Chucks)

LATHE DOGS AND ATTACHMENTS
Armstrong Bros. Tool Co., Chicago.
Hendey Machine Co., Torrington, Conn.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

LATHES, AUTOMATIC AND SEMI AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Herbert, Ltd., Alfred, Toronto, Ont.

LATHES, AXLE
Betts Mach. Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, BORING
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.

LATHES, PRECISION, BENCH
J. G. Blount & Co., Everett, Mass.
Canadian Fairbanks-Morse Co., Montreal.
Geo. F. Foss Machy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Seneca Falls Mfg Co., Seneca Falls, N.Y.
Strelinger Co., C. A., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, BRASS
Ackworthie Ltd., J., Birmingham, Eng.
Acme Machine Tool Co., Cincinnati, Ohio
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, ENGINE
Acme Machine Tool Co., Cincinnati, O.
John Bertram & Sons, Co., Dundas.
Canada Machy. Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal.
G. F. Foss, Mchy. & S'ply Co., Montreal
Garlock-Walker Machinery Co. Toronto.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
Lehman Mach. Co., St. Louis, Mo.
R. McDougall Co., Galt.
Niles-Bement-Pond Co., New York.
Perfect Machine Co., Galt, Ont.
Standard Equipment & Tool Wks, Montreal, P.Q.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Sidney Tool Co., Sidney, Ohio.
Strelinger Co., C. A., Windsor, Ont.
Walcott Lathe Co., Jackson, Mich.
A. R. Williams Machy. Co., Toronto
Williams Mchy Co., A. R., Toronto, Ont

LATHES, FOOT POWER
Seneca Falls Mfg. Co., Seneca Falls, N.Y.

LATHES, HORIZONTAL
Intern'l. Mchy. Supplies Ltd., Montreal.

LATHES, JOURNAL TRUEING
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, PATTERNMAKERS'
J. G. Blount Co., Everett, Mass.
Can. Machinery Corp., Galt.
G. F. Foss Mchy. & S'ply Co., Montreal
Garlock-Walker Machy. Co., Toronto Ont

LATHES, POLISHING
Ackworthie Ltd., J., Birmingham, Eng.
Greenfield Tap & Die Corp., Greenfield
Wells Bros. of Canada, Galt, Ont.

LATHES, SCREW CUTTING
Bertram & Sons Co., John, Dundas, Ont.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & Sply Co., G. F., Montreal
Foster Machine Co., Elkhart, Ind
Garlock-Walker Machy. Co., Toronto, Ont
Hephurn Ltd., John T., Toronto, Ont
Lehman Machine Co., St. Louis, Mo.
Niles-Bement-Pond Co, New York.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Strelinger Co., C. A., Windsor, Ont.
Williams Machy. Co., A. R., Toronto.

LATHES, SPINNING
Bliss Co., E. W., Brooklyn, N.Y.

LATHES, TOOL ROOM
Canada Machinery Corporation, Galt, Ont
Lehman Machine Co., St. Louis, Mo.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Strelinger, Chas. A. Co., Windsor, Ont.

LATHES, QUICK CHANGE
Lehman Machine Co., St. Louis, Mo

LATHE SAWS
Atkins & Co., E. C., Hamilton, Ont.

LATHES, TURRET
Acme Machine Tool Co., Cincinnati, Ohio
Herbert Ltd., Alfred, Toronto, Ont.

LEAD, PIG AND BAR
British Smelting & Refining Co., Ltd. Montreal, Que.
Hoyt Metal Co., Toronto, Ont.

LEAD BURNING OUTFITS
Turner Brass Works, Sycamore, Ill.

LEATHER STRAPPING
Graton & Knight Mfg. Co., Worcester, M

LENSES FOR GOGGLES
Standard Optical Co., Geneva, N.Y.

LEVELS
Hughes, Owens Co., Ltd., Montreal, Que

LIDS, SCREW TOP AND HINGE
Can. Winkley Co., Ltd., Windsor, Ont

LINK BELTING
See Belting, Chain.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LOCKERS, STEEL WARDROBE AND STEEL MATERIAL
Canada Wire & Iron Gds. Co., Hamilton
Dennis Wire & Iron Works, London, Ont

LUBRICANTS
Cataract Refining & Mfg. Co., Toronto
Swan & Finch, Inc., New York.

LUBRICANTS, CUTTING AND GRINDING, DRAWING, STAMPING
Oakley Chemical Co., New York, N.Y.

LUBRICATING, OIL FILTERING AND CIRCULATING SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.

LUBRICATORS
Trahern Pump Co., Rockford, Ill.

LUMBERMEN'S TOOLS
Thos. Pink Co., Ltd., Pembroke, Ont

MACHINE COUNTER WEIGHTS
Katie Foundry, Galt, Ont.

MACHINE TOOLS
Barber Mach. Co., F. F., Toronto, Ont

MACHINERY DEALERS
Archibald & Co., Chas. P., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machy. Co., Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Machy. Co., A. R., Toronto.

MACHINERY GUARDS (See Guards)

MACHINERY SUPPLIES
Crescent Machine Co., Ltd., Montreal
Globe Engineering Wks., Hamilton, Ont.

MACHINERY, SPECIAL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Que.
McClean Machine & Tool Co., Ltd., Hamilton, Ont.

MACHINISTS' TOOLS
Atkins & Co., E. C., Hamilton, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

MAGNETIC BRAKES FOR ELECTRIC MOTORS
Volta Mfg. Co., Welland, Ont.

MANDRELS
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Montreal
Cleveland Twist Drill Co., Cleveland
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.

MARKING MACHINERY
Brown, Boggs Co., Hamilton, Ont.
Foss Mchy. & S'ply Co. G. F., Montreal
Perrin, Wm. R., Toronto.
Petrie, Ltd., H. W., Toronto.

MATS, RUBBER MATTING
Quaker City Rubber Co., Philadelphia, Pa
International Mchy. Sply., Ltd., Montreal

MEASURING MACHINES
Pratt & Whitney Co., Dundas, Ont

MEASURES, REGISTERING
Bowser Co., Ltd., S. F., Toronto, Ont

MEASURING TAPES AND RULES
Chesterman & Co., Jas., Sheffield, Eng

MERCHANTS, IRON AND STEEL
Samuel Osborne (Can.), Ltd., Montreal

METALLURGISTS
See Chemists.

METAL CLEANERS
Oakley Chemical Co., New York, N.Y.

METAL CUTTING MACHINES
Atkins & Co., E. C., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.

METAL SAWS
See Saws.

METAL SAWS, POWER
E. C. Atkins & Co., Inc., Indianapolis.
Hoefer Mfg. Co., Freeport, Ill.
Lyman Tube & Supply Co., Montreal, Que.

METALS
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.
Canada Metal Co., Toronto, Ont.
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
Hoyt Metal Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.

METAL, STAMPINGS, SMALL
Can. Winkley Co., Ltd., Windsor, Ont.

METERS, OIL, GASOLINE, KEROSENE, ETC.
Bowser Co., Ltd., S. F., Toronto, Ont.
General Combustion Co., Ltd., Montreal, Que.

MICROMETERS
Taylor, J. A. M., 318 Stair Bldg., Toronto
Petrie, Ltd., H. W., Toronto.

MILLS, BRACE AND TUBE
Elec. Steel & Metals, Welland, Ont.

MILL SPECIALTIES
Atkins & Co., E. C., Hamilton, Ont.

MILLS, SAND
Frost Mfg. Co., Chicago, Ill.

MILL MACHINERY
Alexander Fleck, Ltd., Ottawa.
Greenfield Tap & Die Corp., Greenfield
Wells Bros. of Canada, Galt, Ont.

MILLING ARBORS
Ackworthie Ltd., J., Birmingham, Eng.
Carter Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee Wis.
Strelinger, Chas. A. Co., Windsor, Ont.

MILLING ATTACHMENTS
Ackworthie Ltd., J., Birmingham, Eng.
Bertram & Sons Co., John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co. Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Hendey Mach. Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.

MILLING MACHINES, AUTOMATIC
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Betts Machine Co., Rochester, N.Y.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.

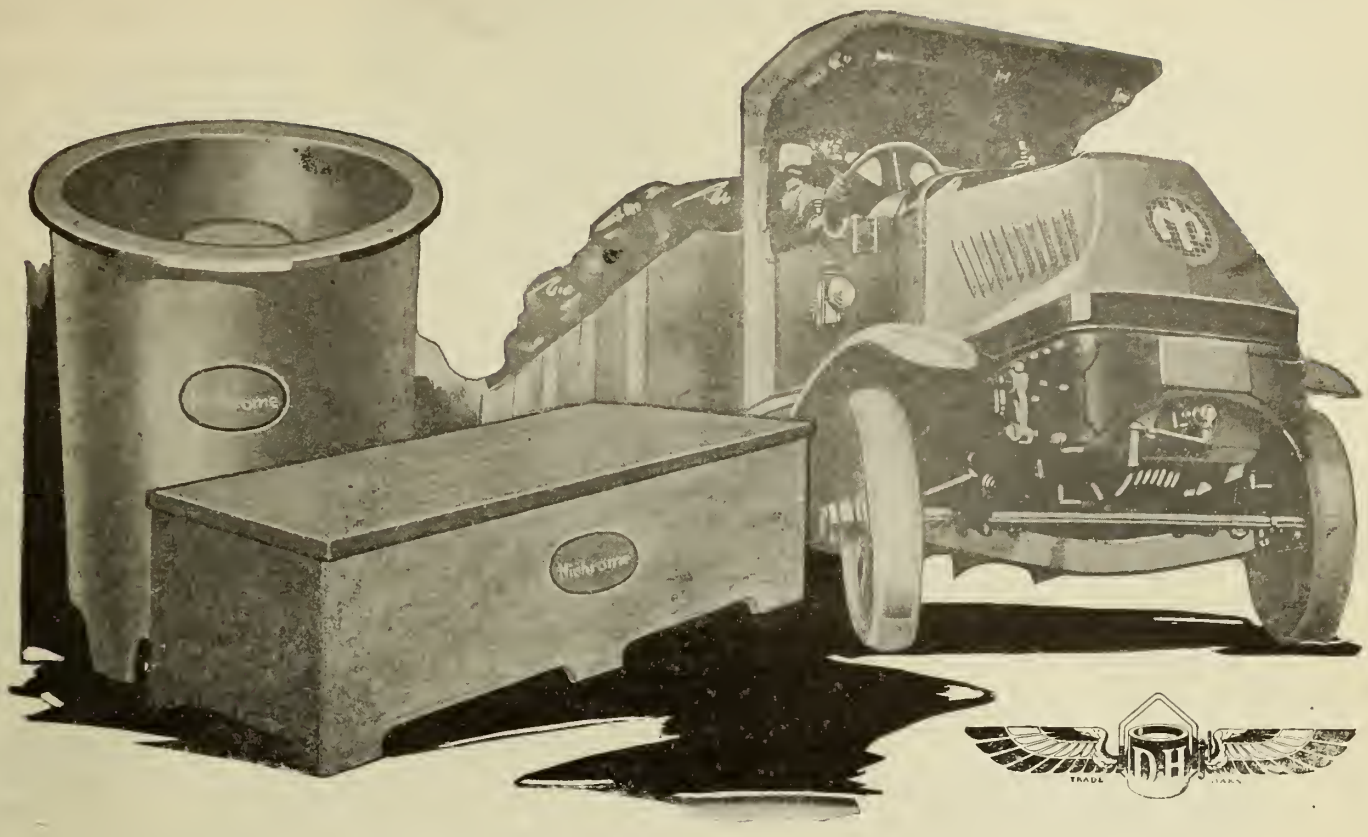
MILLING CUTTERS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Milling Machine Co., Cleveland.
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
Herbert, Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

MILLING MACHINES, HAND
Bristol Machine Tool Co., Bristol, Conn.

MILLING MACHINES, THREAD
Gisholt Machine Co., Madison, Wis.
United States Mach. Tool Co., Cincinnati
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.
Strelinger, Chas. A. Co., Windsor, Ont.

MILLING MACHINES, HORIZONTAL AND VERTICAL
Bristol Machine Tool Co., Bristol, Conn.
Brown & Sharpe Mfg. Co., Providence.
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Cochrane-Bly Co., Rochester, N.Y., U.S.A
Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Herbert, Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
...ne Ltd., H. W., Toronto.
Rockford Milling Mach. Co., Rockford, Ill
Strelinger, Chas. A. Co., Windsor, Ont.
United States Mach. Tool Co., Cincinnati.
Williams Machy. Co., A. R., Toronto

MILLING MACHINES, PLAIN, BENCH AND UNIVERSAL
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence
Canada Machinery Corp., Galt, Ont.
Cleveland Milling Machine Co., Cleveland.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.



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BRITISH WORKS MANCHESTER ENGLAND

Cast Nichrome

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If interested tear out this page and place with letters to be answered.

Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Herbert, Ltd., Alfred, Toronto, Ont.
National Machy. Co., Tiffin, Ohio.
Gooley & Edlund, Inc., Cortland, N.Y.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.
Strelinger, Chas. A. Co., Windsor, Ont.

MILLING MACHINES, PROFILE

Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

MILLING TOOLS

Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MINE CARS

Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dominion Bridge Co., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Pratt & Whitney Co., Dundas, Ont.

MINING MACHINERY

Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.
Holden Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MIXERS, SAND

Frost Mfg. Co., Chicago, Ill.

MORTISING CHAINS

Renold of Canada Ltd., Montreal.

MORTISING MACHINES

Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.

MOTORS, ELECTRIC

Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Toronto.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Sturtevant Co., B. F., Galt, Ont.
Volta Mfg. Co., Welland, Ont.
Williams Mach'y Co., A. R., Toronto.

MOTOR SPRINGS

The Dunbar Brothers Co., Bristol, Conn.

MOTORCYCLE FRAME AND FORK

The Dunbar Brothers Co., Bristol, Conn.

MOTORS, PNEUMATIC

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto.
Holden Co., Ltd., Montreal, Que.

MOULDS, RUBBER

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

MULTIPLE INDEX CENTRES

Garvin Machine Co., New York.
Graton & Knight Mfg. Co., Worcester, Mass.

MULTI-DRILLING, MULTI-BORING, MULTI-TAPPING MACHINERY,

Nat. Automatic Tool Co., Richmond, Ind.

MUNICIPALITIES

City of St. John, Quebec.

NAIL SETS

Morrow Screw & Nut Co., J., Ingersoll, Ont.

NAME PLATES, BRONZE, ETCHED AND STAMPED

Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS

Can. Driver-Harris Co., Ltd., Walkerville.

NICKEL

Pilot Steel & Tool Co., Montreal, Que.

NICKEL STEEL

See Steel.

NICKEL SILVER—SHEETS, ROLLS, PLATES and RODS

Brown's Copper and Brass Rolling Mills, New Toronto.

NIPPLE THREADING MACHINES

Landis Machine Co., Waynesboro Pa.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

NITROGEN

Carter Welding Co., Toronto, Ont.

NUTS, STEEL, CASTELLATED AND COLD PRESSED

Galt Machine Screw Co., Ltd., Galt, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Williams & Co., J. H., Brooklyn, N.Y.

NUTS, SEMI-FINISH AND FINISHED

Gast Machine Screw Co., Galt, Ont.
National-Acme Co., Cleveland, Ohio.
Wilkinson & Kompass, Hamilton.

NUT LOCKS

Edw. W. Robinson Co., Ltd., Montreal.

NUT BURRING AND NUT MACHINES (HOT)

National Machy. Co., Tiffin, Ohio.

NUT FACING AND BOLT SHAVING MACHINES

Garvin Machine Co., New York.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Victor Tool Co., Waynesboro, Pa.

NUT TAPPERS

Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

OILERS

All-Way Oiler Mfg. Co., Toronto, Ont.

OIL SEPARATORS

Can. Fairbanks-Morse Co., Montreal.

OIL STONES

Aikenhead Hardware Co., Toronto, Ont.
Carborundum Co., Niagara Falls N.Y.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Norton Co., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

OIL STONE GRINDERS

Oliver Machy. Co., Grand Rapids, Mich.

OIL STORAGE SYSTEMS

Bowser Co., Ltd., S. F., Toronto, Ont.

OPENING DIE HEADS

Greenfield Tap & Die Corp, Greenfield
Wells Bros. of Canada, Galt, Ont.

ORE HANDLING EQUIPMENT

Brown Hoisting Machinery Co., Cleveland, Ohio.
Canadian Link-Belt Co., Ltd., Toronto, Ont.

OSCILLATING VALVE GRINDERS (PNEUMATIC)

Cleveland Pneumatic Tool Co. of Canada Toronto.

OVENS FOR BAKING, BLUING, DRYING, ENAMELING, JAPANNING AND LACQUERING

Brantford Oven & Rack Co., Brantford

OVEN TRUCKS, STEEL

Brantford Oven & Rack Co., Brantford.
MacKinnon Steel Co., Sherbooke, Que.

OVENS FOR DRYING, TEMPER AND OXYGEN, ELECTROLYTIC CELLS UNDER TRUCKS

Brantford Oven & Rack Co., Brantford

OXY-ACETYLENE WELDING AND CUTTING AND OUTFITS

Carter Welding Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
L'Air Liquide Society, Toronto, Ont.
Prest-o-Lite Co., Inc, Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.

OXYGEN

Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.
Nat. Electro Produots Ltd., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.

OXYGEN PLANTS (ELECTROLYTIC)

Davis-Bournonville Co., Toronto, Ont.

PACKINGS, ASBESTOS

Cleveland Wire Spring Co., Cleveland.

PACKING, ROD AND SHEET

Dunlop Tire & Rubber Goods Co., Ltd. Toronto.
Goodyear Tire & Rubber Co., Can., Ltd., Toronto
Gutta Percha & Rubber, Ltd., Toronto.
International Mach. Spls., Ltd., Montreal
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co., Philadelphia, Pa

PANS, WET AND DRY

Frost Mfg. Co., Chicago, Ill.

PAPER MILL CONVEYORS AND DRIVES

Bertrams, Ltd., Edinburgh, Scotland.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Gutta Percha & Rubber, Ltd., Toronto.
MacKinnon Steel Co., Sherbrooke, Que.

PARTITIONS, WIRE

See Guards

PAPER MILL MACHINERY

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

PATTERN SHOP EQUIPMENT

Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Oliver Machy. Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.

PATTERN MAKERS' LATHES

See Lathes.

PATENT SOLICITORS

Fetherstonhaugh & Co., Ottawa.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.

PECK CARRIERS FOR POWER PLANTS

Can. Link-Belt Co., Toronto, Ont.

PENSTOCKS

William Hamilton Co., Peterboro, Ont.

PERFORATED METALS AND ORNAMENTAL IRON GOODS

Canada Wire & Iron Goods Co., Hamilton

PHOSPHOR TIN, COPPER AND BRONZE

British Smelting & Refining Co., Ltd., Montreal, Que.

PHOTOSTATS

Commercial Camera Co., Providence, R.I.

PIG IRON

Hanna & Co., M. A., Cleveland, O.
Steel Co. of Canada, Ltd., Hamilton, Ont

PINS, TAPER

Morrow Screw & Nut Co., J., Ingersoll, Ont

PINS, BELT-LACING

Clipper Belt Lacer Co., Grand Rapids.

PIPE, BLACK & GALVANIZED

Crane, Ltd., Montreal, Que.

PIPE FITTINGS, MALLEABLE AND CAST IRON

International Malleable Iron Co., Guelph.

PIPE CUTTING AND THREADING MACHINES

Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
McDougall Co., R., Galt.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

PIPE, JOINT COMPOUNDS

Crane, Ltd., Montreal, Que.

PIPE RIVETED STEEL

Toronto Iron Works, Ltd., Toronto.
William Hamilton Co., Peterboro, Ont.

PIERCING

Oliver Machy. Co., Grand Rapids, Mich.

PIPE CUTTERS, ROLLING

Greenfield Tap & Die Corp., Greenfield.
Wells Bros. Co. of Canada, Galt, Ont
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

PIPE TOOLS AND DIES

Ackworthie Ltd., J., Birmingham, Eng.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE CUTTERS AND REAMERS

Greenfield Tap & Die Corp. Greenfield.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. of Canada, Galt, Ont.

PIPE STOCKS AND THREADERS

Greenfield Tap & Die Corp. Greenfield.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. of Canada, Galt, Ont.

PIPE TAPS AND VISES

Ackworthie Ltd., J., Birmingham, Eng.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE WRENCHES

Greenfield Tap & Die Corp. Greenfield.
Wells Bros. of Canada, Galt, Ont.

PISTON AND PISTON RING MACHINES

National Acme Co., Windsor, Vt.

PLANER BOLTS

Atkins & Co., E. C., Hamilton, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont

PLANER JACKS

Armstrong Bros. Tool Co., Chicago.

PLANERS, STANDARD AND ROTARY

Betts Machine Co., Rochester, N.Y.
Bertram & Sons Co., John, Dundas.
Oliver Machy. Co., Grand Rapids, Mich.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Gardner & Son, Robt., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Herbert Ltd., Alfred, Toronto, Ont.
Morton Mfg. Co., Muskegon Heights, Mich
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
Standard Equipment & Tool Wks., Montreal.

PLANING AND SHAPING MACHINERY

Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
Herbert, Ltd., Alfred, Toronto, Ont.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William, Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co. Ltd., A. R., Montreal

PLANER-SHAPER, COMBINED OPEN SIDE

Petrie, Ltd., H. W., Toronto.

PLANING MILL EXHAUSTERS

Can. Blower & Forge Co., Kitchener, Ont.
MacGovern & Co., Montreal, Que.
Niles-Bement-Pond Co., New York.
Sturtevant Co., B. F., Galt, Ont.

PLATES, Q.M., SHEARED AND CHEQUERED

Pechovers, Ltd., Toronto, Ont.

PLIERS

Aikenhead Hardware Co., Toronto.
Rice Lewis & Son, Toronto, Ont.

PNEUMATIC CYLINDERS

Holden Co., Ltd., Montreal, Que.

PNEUMATIC EQUIPMENT

Strelinger Co., C. A., Windsor, Ont.

PNEUMATIC TOOLS

Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Can., Toronto.
Curtis Pneumatic Machy. Co., St. Louis.
Garlock-Walker Machy. Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Chicago.
Int. Mach. & Supply Co., Ltd., Montreal.
Strelinger, Chas. A. Co., Windsor, Ont.

POWER CRANES, HAND

MacKinnon Steel Co., Sherbrooke, Que.

POLISHING MACHINES

Ackworthie Ltd., J., Birmingham, Eng.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto.

POLISHING PLATES

Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. of Canada, Galt, Ont.

POTS AND KETTLES, CAST STEEL

Elec. Steel & Metals, Welland, Ont.

POWER HOUSE CONVEYORS

Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Hesbert, Niagara Falls, Ont.

PORTABLE MACHINERY

Haskins & Co., R. C., Chicago, Ill.

POWER TRANSMISSION MCHY

Canadian Link-Belt Co., Ltd., Toronto.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Petrie, Ltd., H. W., Toronto.

PRECISION MACHINES

Herbert Ltd., Alfred, Toronto, Ont.

PRESSED STEEL PARTS

Ackworthie Ltd., J., Birmingham, Eng.

PRESSERS, ARBOR

Atlas Press Co., Kalamazoo, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
Lourie Manufacturing Co., Springfield, Ill.

PRESSES, BROACHING, FORGING AND FLANGING

Atlass Press Co., Kalamazoo, Mich.
Bliss Co., E. W., Brooklyn, N.Y.
Dom. Steel Products Co., Ltd., Brantford
Eastern Production Co., Detroit, Mich.
Metalwood Mfg. Co., Detroit, Mich
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, CAM, TOGGLE, EYELET

Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn N.Y.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.

PRESSES, FILTER

Perrin, Ltd., William R., Toronto.

PRESSES, PNEUMATIC

Dom. Steel Products Co., Ltd., Brantford.
Eastern Production Co., Detroit, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Toledo Machine & Tool Co., Toledo.

PRESSES, DROP AND FORGING

Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can. Fairbanks-Morse Co., Montreal
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co, Toledo.

PRESSES, HYDRAULIC

Bertram & Sons Co., John, Dundas.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke.
Dom. Steel Products Co., Ltd., Brantford.
Eastern Production Co., Detroit, Mich.
Lourie Manufacturing Co., Springfield, Ill.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., Inc., D. H., Buffalo, N.Y
Williams Machy. Co., A. R., Toronto.

PRESSES, HYDRAULIC, HORIZONTAL

Eastern Production Co., Detroit, Mich.

PRESSES, HYDRAULIC, VERTICAL

Eastern Production Co., Detroit, Mich.

PRESSES, HYDRO-PNEUMATIC

Eastern Production Co., Detroit, Mich.

PRESSES, BALING

Perrin, Ltd., William R., Toronto.

Here Is Action For You

We have tried to catch, in this photograph, some impression of the intense activity that is characteristic of this "BLISS" No. 69 N, Double Action Cam Drawing Press in the plant of the Aluminum Specialty Co., Manitowoc, Wis., throughout every minute of the working day.

It is cutting, drawing and lifting out bowls for soup ladles from 26 gauge, 6" strip aluminum.



BLISS

1857

E. W. Bliss Company

Main Offices: BROOKLYN, N. Y., U. S. A.

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BLISS

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If interested tear out this page and place with letters to be answered.

PRESSES, POWER
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Machy. Co., A. R., Toronto.

PRESSES, SPRING FOOT
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, SCREW
Bliss Co., E. W., Brooklyn, N.Y.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.

PRESSES, TIRE
Can. Ingersoll-Rand Co., Ltd., Sherbrooke.

PRESSES, TRIMMING
Bliss Co., E. W., Brooklyn, N.Y.
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.

PROFILING MACHINES
Herbert Ltd., Alfred, Toronto, Ont.

PROJECTORS, FLOOD LIGHTING
Holden Co., Ltd., Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que

PROPELLERS
Kennedy & Sons, Wm., Owen Sound.

PROTECTIVE COATINGS
H. H. Robertson, Ltd., Sarnia, Ont.

PSYCROMETERS, SLING
Taylor Instrument Co., Rochester, N.Y.

PULLEYS
Algoma Steel Corp., Sault Ste. Marie, Ont
American Pulley Co., Philadelphia.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., Fortierville, Que.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Diamond State Fibre Co., Bridgeport, Pa.
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Kennedy & Sons, Ltd., W., Owen Sound.
Positive Clutch & Pulley Works Ltd., Toronto.
Petrie, Ltd., H. W., Toronto.

PULLEYS, STEEL SASH, STEEL BELT
American Pulley Co., Philadelphia, Pa.

PULLEYS, FRICTION, CLUTCH
American Pulley Co., Philadelphia, Pa.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mch. Co., Manchester, Ct.
Hamilton, Co., Ltd., Wm., Peterborough, Ont.
Jones & Glasco, Montreal.
Positive Clutch & Pulley Works, Toronto.
Petrie, Ltd., H. W., Toronto.

PULP MILL MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

PUMPS, AIR LIFT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Holden Co., Ltd., Montreal, Que.

PUMPS, BOILER FEED
Can. Ingersoll-Rand Co., Ltd. Sherbrooke,

PUMPS, CENTRIFUGAL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Darling Bros., Ltd., Montreal, Que.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, FUEL OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Darling Bros., Ltd., Montreal, Que.
Trabern Pump Co., Rockford, Ill.

PUMPS, GEARED
Darling Bros., Ltd., Montreal, Que.
Globe Engineering Co., Hamilton, Ont.

PUMPS, HIGH PRESSURE
Perrin, Ltd., William R., Toronto.

PUMPS, HYDRAULIC
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Clarke & Co., Furniss, Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Darling Bros., Ltd., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, RETURN AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

PUMPS, SPECIAL
Elec. Steel & Metals, Welland, Ont.

PUMPS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, KEROSENE, OIL, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, LUBRICANT, OIL, WATER
Darling Bros., Ltd., Montreal, Que.
Trabern Pump Co., Rockford, Ill.

PUMPS — ROTARY
General Combustion Co., Ltd., Montreal, Que.

PUMP LEATHERS
Graton & Knight Mfg. Co., Worcester.

PUNCHES AND DIES
Atkins & Co., Ltd., Wm., Sheffield, Eng.
E. W. Bliss Co, Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Can.
Can. Blower & Forge Co., Kitchener, Ont.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Gardner & Son, Robert, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Marshall, Son & Blunney, Toronto.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHES, POWER
John Bertram & Sons Co., Dundas, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd, Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Buffalo, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams, Ltd., Edinburgh, Scotland.
Bertrams & Sons, John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton, Ont.
Garlock-Walker Mach'y. Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHES, HAND
Niles-Bement-Pond Co., New York.

PYROMETERS
Bristol Co., Waterbury, Conn.
Shore Instrument & Mfg. Co., New York.
Taylor Instrument Co., Rochester, N.Y.

QUARTERING MACHINES
Bertram & Sons, John, Dundas, Ont.
Niles-Bement-Pond Co., New York.

RAIL BENDERS
Algoma Steel Corp., Sault Ste. Marie, Ont.

RAILROAD TOOLS
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto
Holder Co., Ltd., Montreal, Que.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

RASPS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

RAWHIDE PINIONS (See Gears)

REAMERS
Butterfield & Co., Inc., Rock Island, Que.

REAMERS, ADJUSTABLE
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.
J. A. M. Taylor, 318 Stair Bldg., Toronto
Wells Bros. of Can., Galt, Ont

REAMERS, BRIDGE, EXPANDING AND HIGH SPEED
Atkins & Co., Ltd., Wm., Sheffield, Eng
Aikenhead Hardware Co., Toronto.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Gisholt Machine Co., Madison, Wis.
Lyman Tube & Supply Co., Montreal, Que
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Samuel Osborne, Ltd., Montreal, P.Q.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, STEEL TAPER AND SELF-FEEDING
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, CHUCKING
Ackworthie Ltd., J., Birmingham, Eng.
Atkins & Co., Ltd., Wm., Sheffield, Eng
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. of Canada, Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, HAND
Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, PIN
Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Morrow Screw & Nut Co., John, Ingersoll.
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMER FLUTING MACHINES
Garvin Machine Co., New York.

REAMING MACHINES, PNEUMATIC
Cleveland Pneumatic Co. of Can., Toronto
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.

RECORDING INTRUMENTS
Bristol Co., Waterbury, Conn.
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Rochester, N.Y.

REELS, WIRE AND TEXTILE MFG
American Pulley Co., Philadelphia, Pa.

REGULATORS, AUTOMATIC
Electric Steels & Metals, Ltd., Welland.

REGULATORS, PRESSURE, TEMPERATURE
Can. Fairbanks-Morse Co., Montreal.
Taylor Instrument Co., Rochester, N.Y.

REPAIR WORK — SAWS
Atkins & Co., E. C., Hamilton, Ont.

REPAIR WORK, ALL KINDS
Elec. Steel & Metals, Welland, Ont.

RIVETS,
Aikenhead Hardware Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque.
Rice, Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.

RIVETERS, PNEUMATIC, HYDRAULIC, HAMMER, COMPRESSION
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Chicago
Niles-Bement-Pond Co., New York.

RIVETING MACHINES, ELASTIC, ROTARY BLOW
High-Speed Hammer Co., Rochester.
Petrie, Ltd., H. W., Toronto.
F. B. Shuster Co., New Haven, Conn.
Strelinger Co., C. A., Windsor, Ont.

ROAD BUILDING EQUIPMENT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Holden Co., Ltd., Montreal, Que.

ROAD-MAKING MACHINERY
G. F. Foss Mchy & Sply. Co., Montreal

RODS, PURE NICKEL, MONEL METAL, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville.

ROLLER CHAINS
Can. Link-Belt Co., Toronto.
Jones & Glasco, Montreal.
Lyman Tube & Supply Co., Montreal, Que
Renold of Canada Ltd., Montreal.

ROLLS, BENDING, STRAIGHTENING
John Bertram & Sons Co., Dundas.
Brown, Boggs Co., Ltd., Hamilton.
Can. Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford
Garlock-Walker Machinery Co., Toronto
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo, O.

ROLLS CRUSHING
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

ROLLS AND TABLES
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Elec. Steel & Metals, Welland, Ont.

ROOFING
H. H. Robertson, Ltd., Sarnia, Ont.

ROPE, GALX, MONEL METAL, BRONZE, TILLER AND SASH CORD
Can Driver-Harris Co., Ltd., Walkerville

ROLLING MACHINES, SHEET METAL
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLING MILL MACHINERY
Dom. Steel Products Co., Ltd., Brantford
Mesta Machine Co., Pittsburgh, Pa.

ROLL LATHES
Mesta Machine Co., Pittsburgh, Pa.

ROLLS, BENDING, STRAIGHTENING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLS, CRUSHING
Can. Link-Belt Co., Toronto.

ROOF COOLERS
Electric Steels & Metals, Ltd., Welland

RUBBER MILL DRIVES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford
Can. Link-Belt Co., Toronto.

RUBBER MILL MACHINERY
Bertrams Ltd., Edinburgh, Scotland.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford

RUBBER MOULDS & CORES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

RUBBER PRODUCTS, MECHANICAL
Dunlop Tire & Rubber Goods Co., Ltd. Montreal.

RUBBING BRICKS
Dominion Abrasive Co., Mimico, Ont.

RULES
Brown & Sharpe Mfg. Co., Providence.
James Chesterman & Co., Ltd., Sheffield
Rice, Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N.Y.

SAW MILL CONVEYORS
Can. Link-Belt Co., Toronto.
Petrie, Ltd., H. W., Toronto.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.

SAND MIXING MACHINERY
Frost Mfg. Co., Chicago, Ill.

SANITARY DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co., Haydenville.

SANDING MACHINES
Canada Machinery Corp., Galt.

SAW MILL MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt.
Robert Gardner & Son, Montreal.
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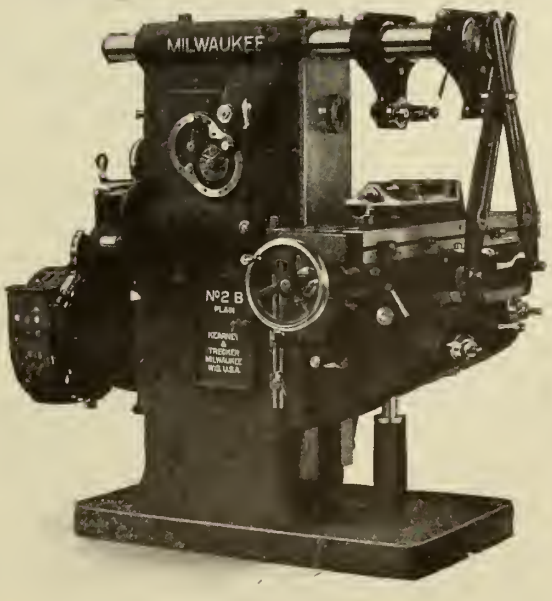


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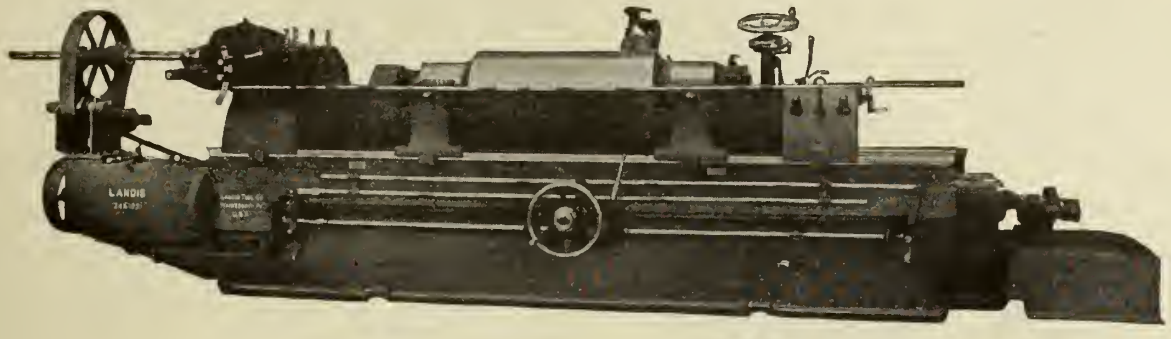
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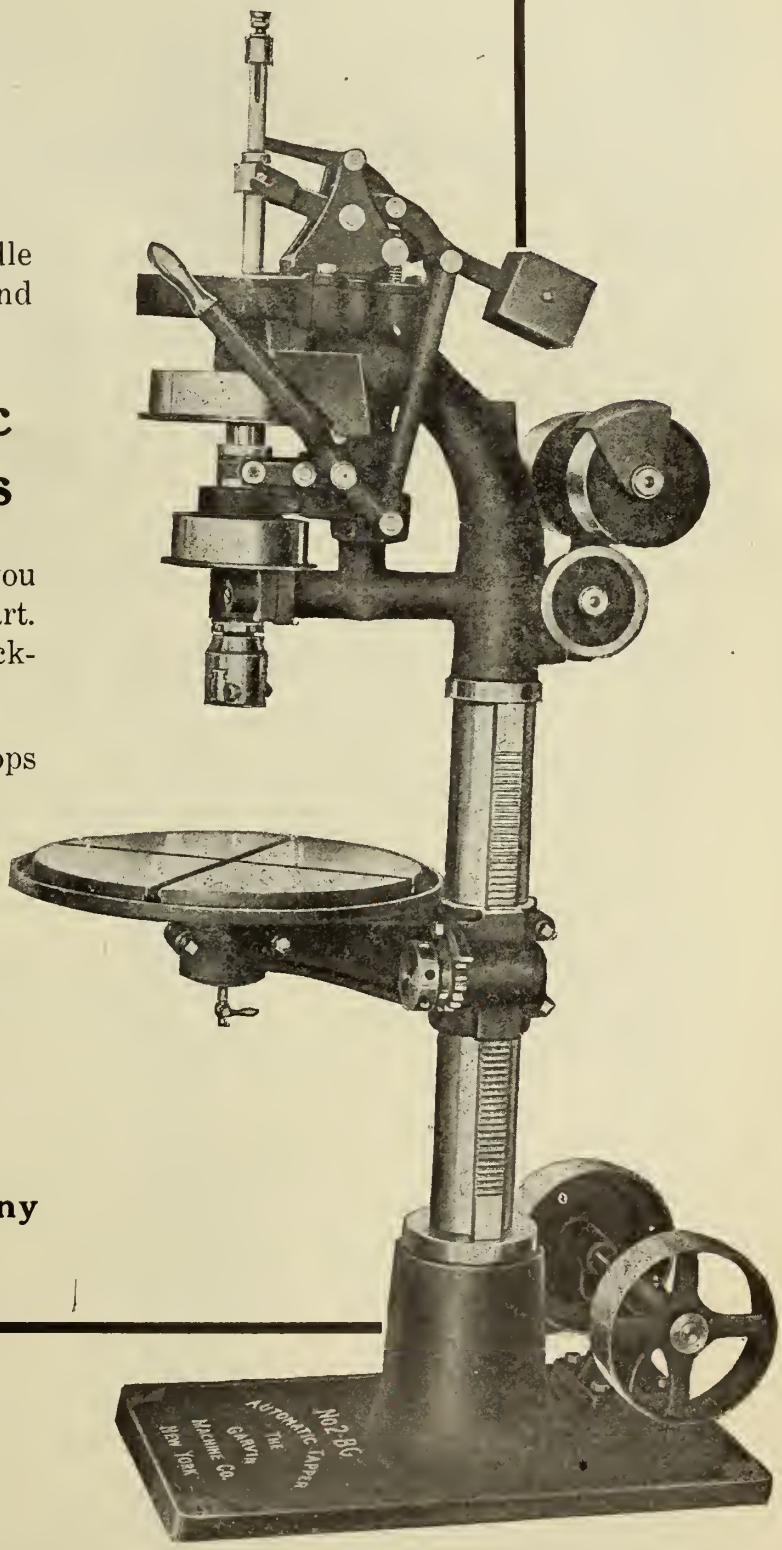
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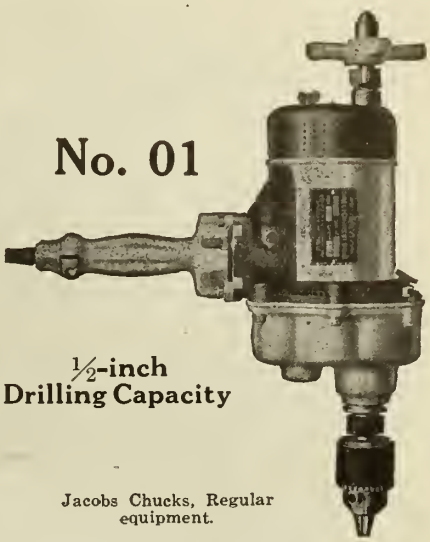
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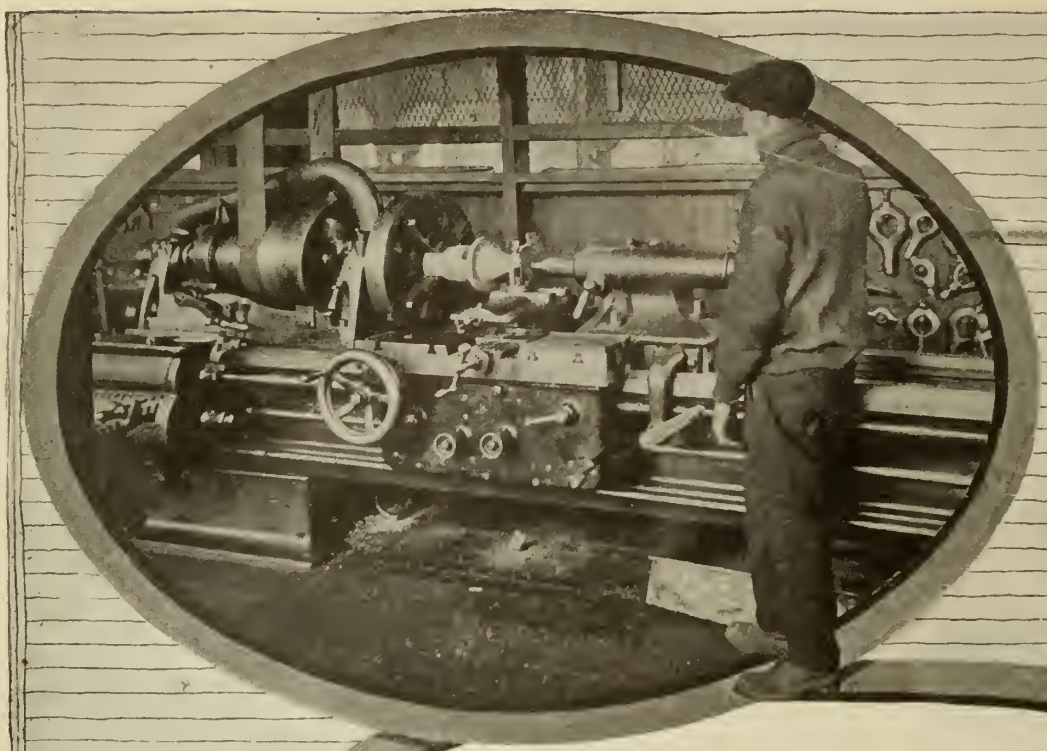
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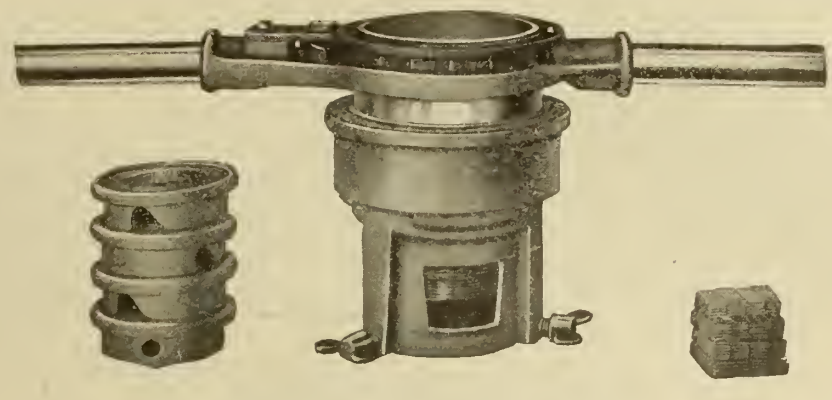
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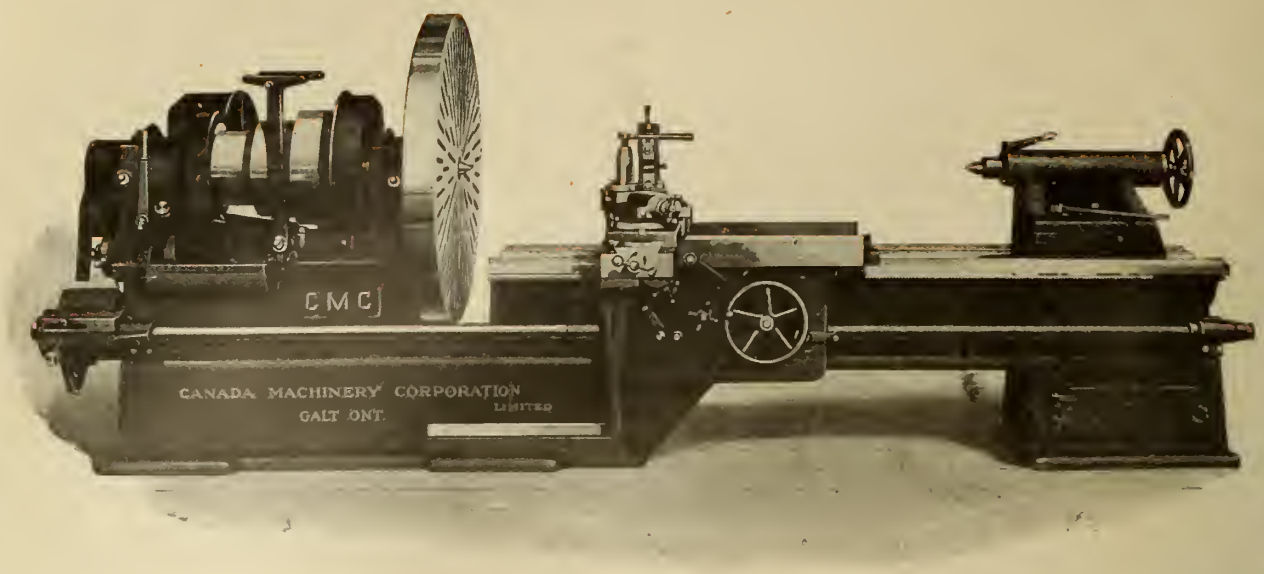


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42-107

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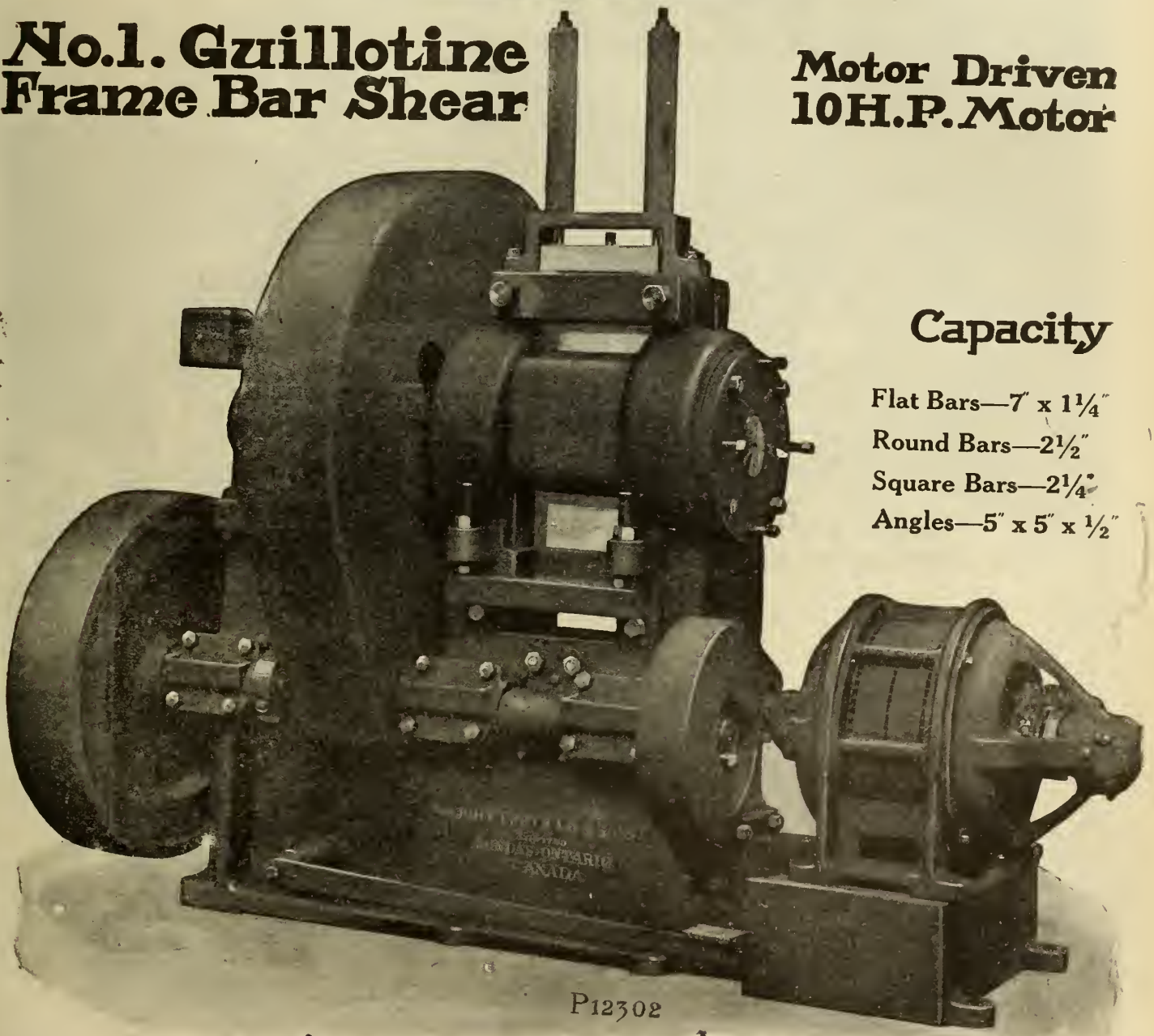
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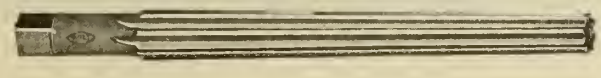
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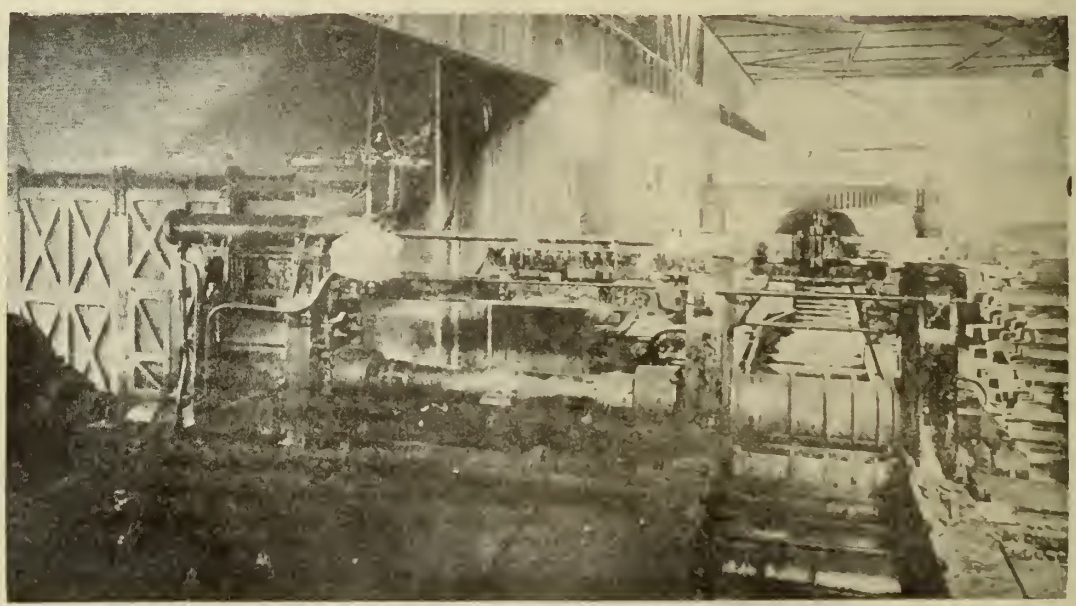
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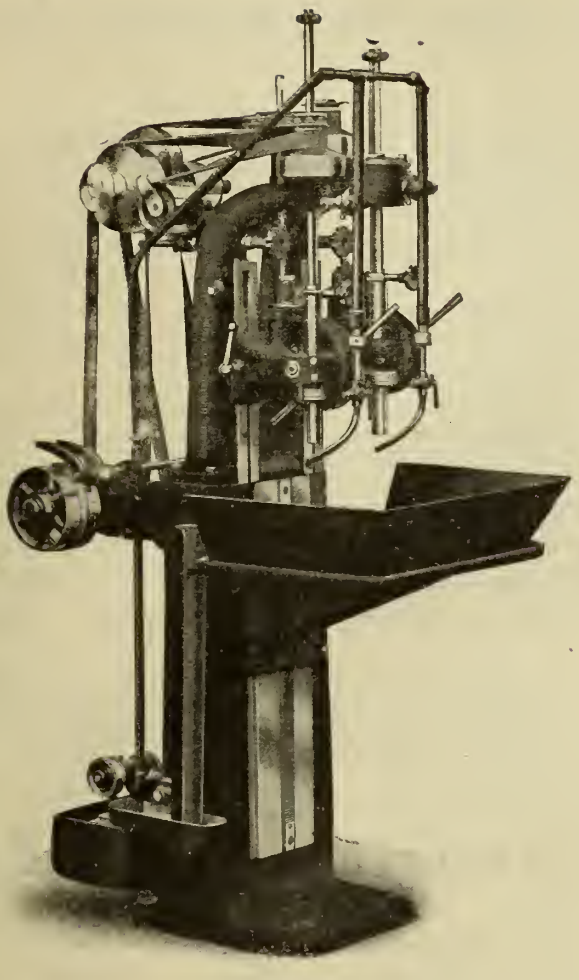
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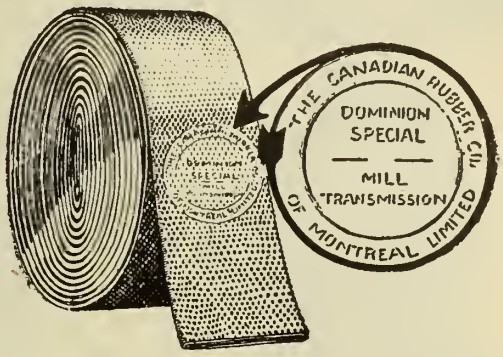
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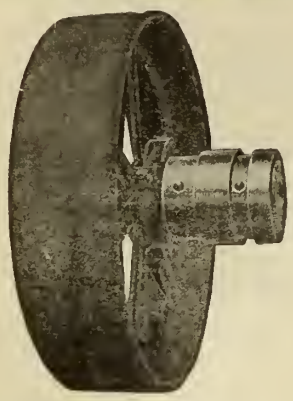
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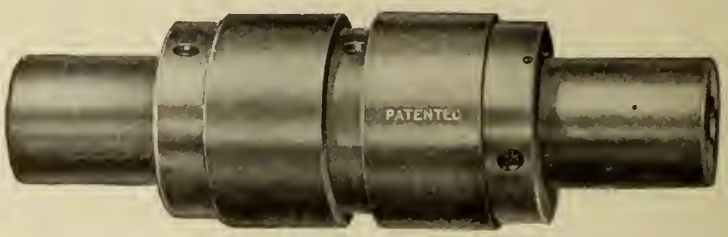


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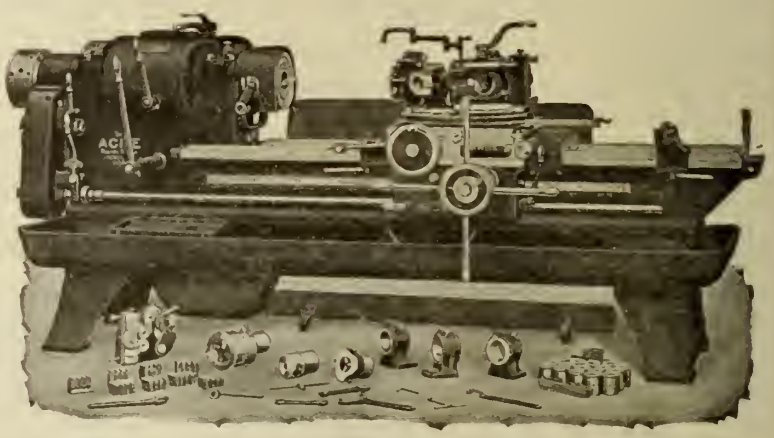
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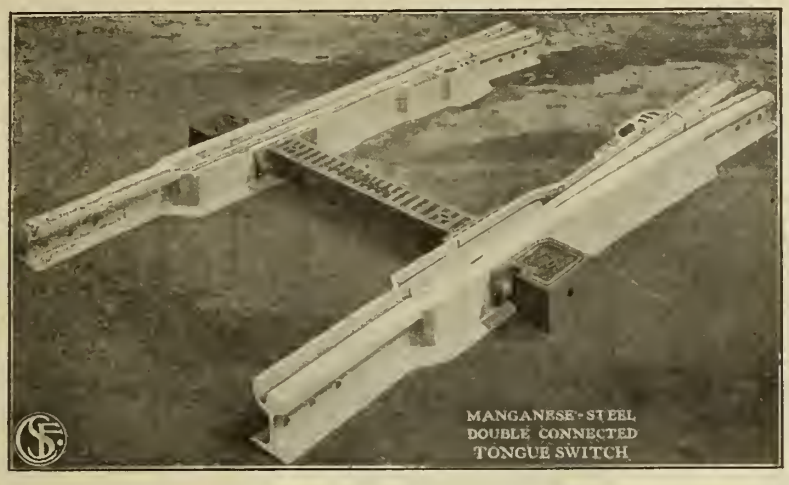
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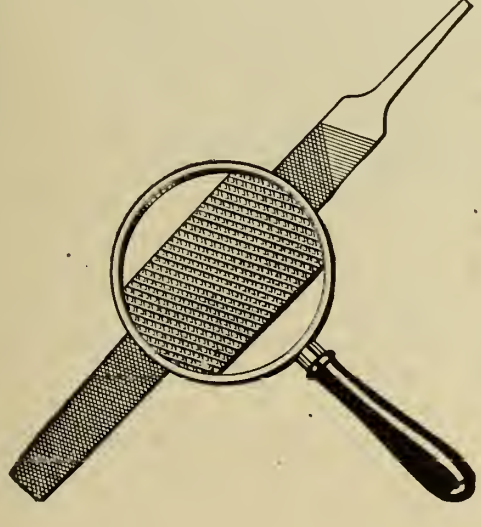
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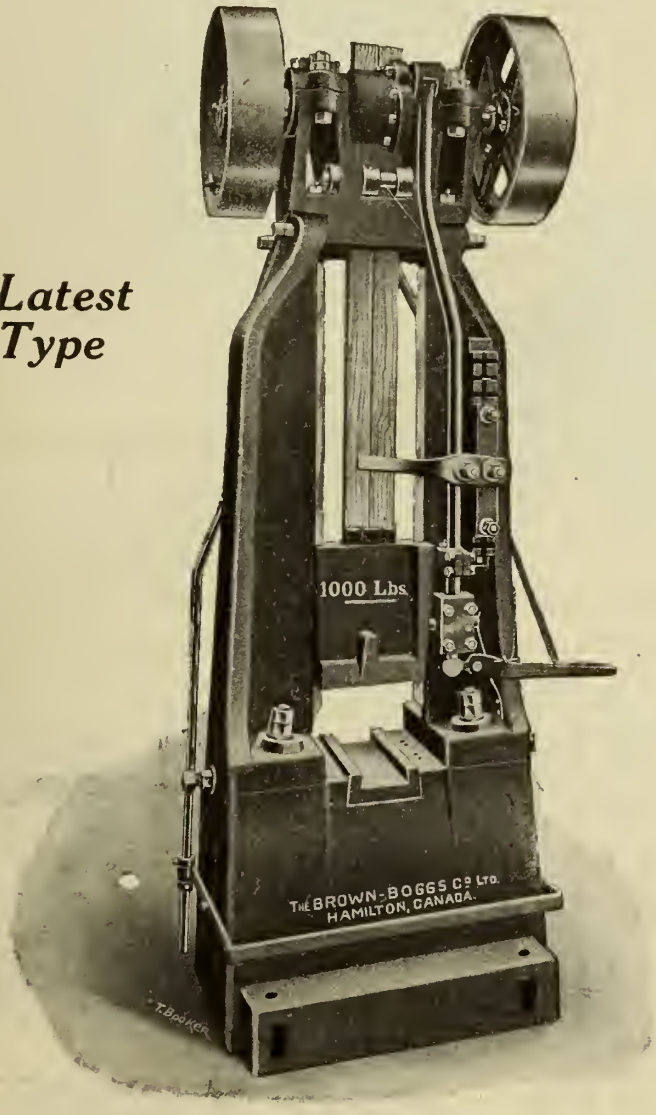
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B-B Drop Hammers

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The old-fashioned, noisy gears have been eliminated entirely, the hammer being lifted by friction exerted through a powerful eccentric motion under perfect control of the operator at all times.

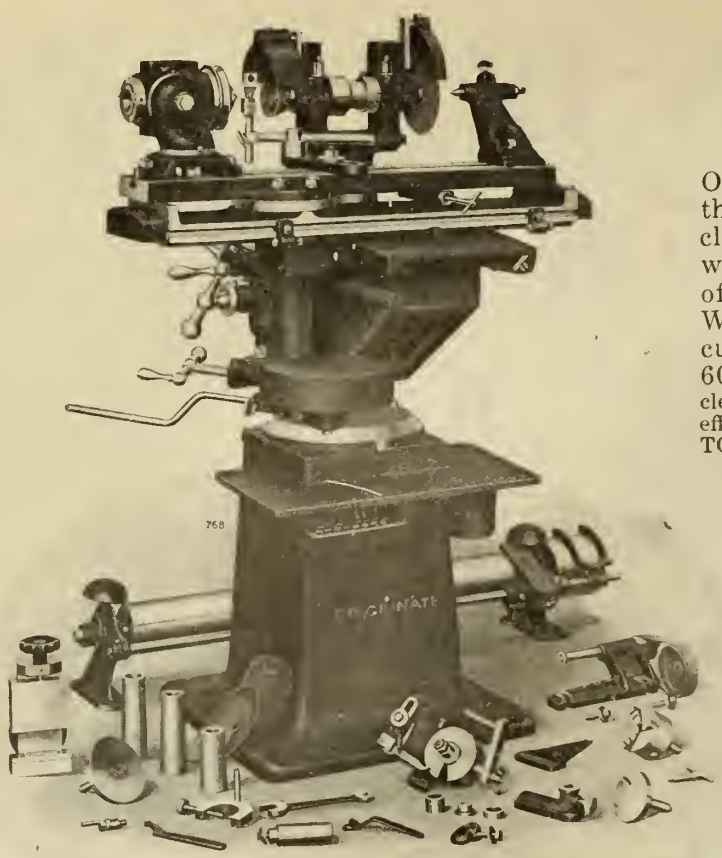
The hammer has exclusive features that add greatly to its life as well as increasing the quantity of work produced.

Let us know the type of hammer you are interested in and we will give you full information and advice.

Manufacturers of Sheet Metal Working Machinery, Presses, Shears, Rolls, etc.

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Investigate Your Cutter-Sharpening Facilities

Our wide experience in milling has proved the necessity of having exactly the correct clearance on cutters. But cutter grinders were too incomplete to insure reproduction of the right clearance on repeated grindings. We set ourselves the task of solving this difficulty. The 40 per cent., 50 per cent. or 60 per cent. increased output that proper clearance means was certainly worthy of our best efforts. In the No. 1½ UNIVERSAL CUTTER AND TOOL GRINDER we offer you the result—a simple, correct clearance angle feature.

The machine carries a graduated dial on its head-stock spindle from which the clearance angle for all cutters may be read directly.

As a result of obtaining this correct clearance angle the feed may be greatly increased; the cutter cuts as it was designed to; the tendency to chatter is removed—and you get greater efficiency from your millers.

Send for the bulletin and get the whole truth of the matter.

Cincinnati Milling Machine Co.

Cincinnati, Ohio, U.S.A.

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The

NAZEL AIR HAMMER

NOTED FOR ITS BLOW AND CONTROL

A self-contained unit, HAMMER AND COMPRESSOR COMBINED, built in three types, six sizes arranged for BELT OR DIRECT MOTOR DRIVE, with capacities up to 7 inches square, for all manner of jobbing, manufacturing and certain classes of drop forgings.

Nazel Engineering & Machine Works

Dept. F., Philadelphia, Pa.



PERRIN 400-Ton Hydraulic Wheel Press

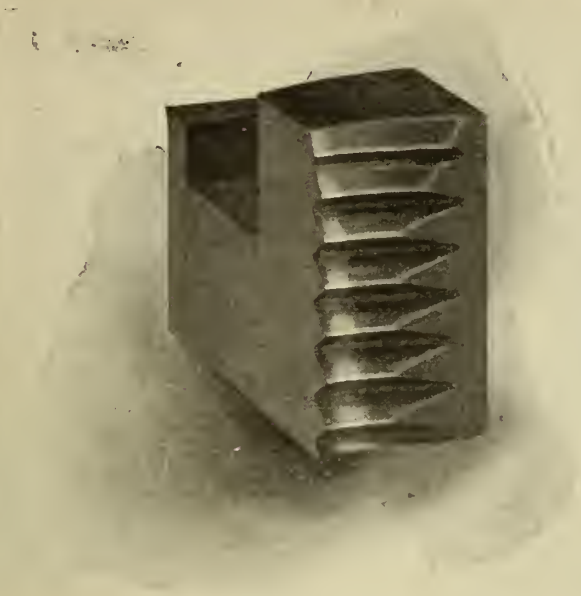
This Made-in-Canada Press is built to operate direct from Accumulator at 1500 pounds per square inch pressure.

Perrin for Reliability

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Don't Scrap the other Chasers

If one in a set breaks

Put in a New Chaser

Grinding set to uniformity.

This *Is* Practicable *If* You Use

HARTNESS AUTOMATIC DIES

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(DIE DIVISION)

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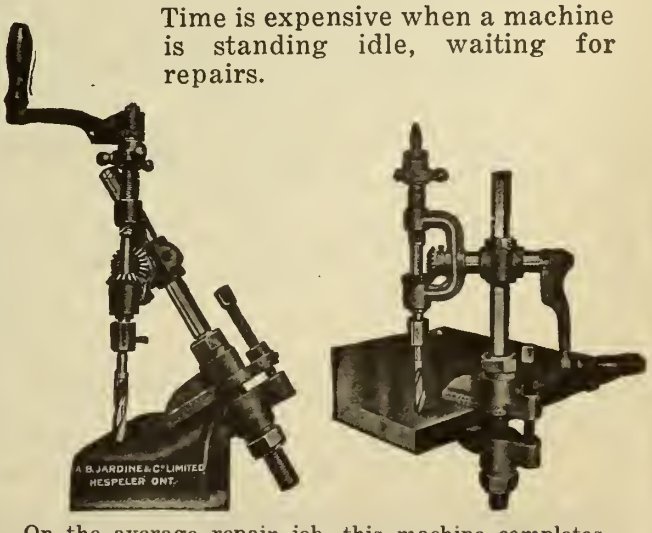
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Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

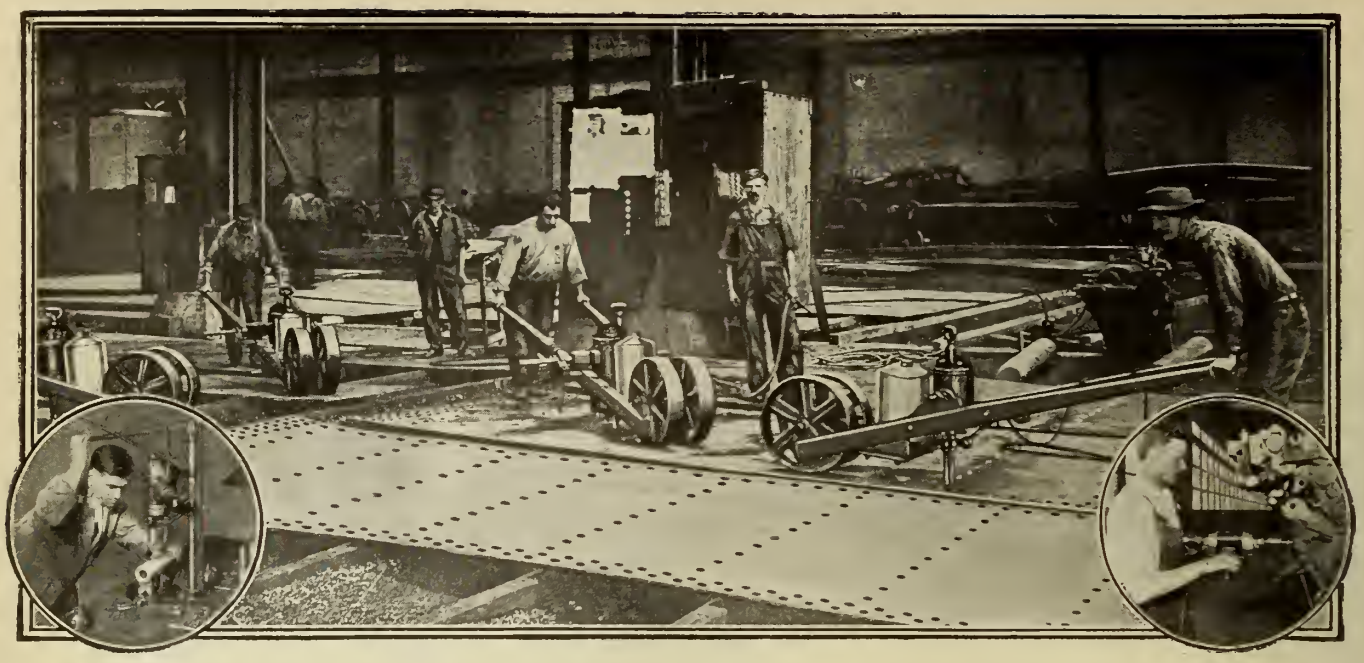
Weight, 40 lbs. Price, $26.50 net.

Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited

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Little Giant—the Adaptable Electric Drill

GOOD Drills, like good men, perform dependable work and require little attention.

Six years ago the Little Giant Electric Drills illustrated, started cutting down production costs in a large Pittsburgh Steel Plant—and they are still hard at it! (The special buggies upon which these Little Giants are mounted, are not manufactured by this Company, but show the adaptability of Little Giant Electric Tools.)

Mounted on buggies, used in stationary drilling stands, or as portable tools, Little Giants tackle and finish scores of drilling, reaming and numerous other jobs with equal facility and dispatch.

What jobs in *your* shops can be done faster, better and cheaper with the aid of Little Giant Electric Tools?

Experienced service engineers at the nearest Company Branch will gladly submit recommendations based upon careful investigation.

Write for Electric Tool Booklet 397

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Canadian Factory: Canadian Pneumatic Tool Company, Montreal

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LITTLE *Electric* **GIANT** *Tools*

"The City of Peril"

By Arthur Stringer

"THE CITY OF PERIL" is full to the brim—and overflowing—with thrills, as it moves with kaleidoscopic swiftness from New York to Petrograd, and back again. Mr. Stringer always writes vividly and picturesquely—and every chapter has its *punch*. No living Canadian author can write more absorbing fiction, or put more compelling action into every chapter. "The Hammer of God" writes mysterious notes which throw Wall Street into a panic. Who is the "Hammer of God?" By reading this short-length novel, which will appear in huge instalments in this and the following issues of MACLEAN'S, you can satisfy your curiosity.

What Will Calder Do ?

NO one knows, not even Mr. Calder, according to J. K. Munro. This article also tells in Mr. Munro's inimitable fashion some secrets of Crerar, the Hired Man's Hero; of Mackenzie King and his all-star Talented Entertainers; of Premier Meighen, who has "hurled himself into the arena, with the National Policy in one hand and an axe in the other."

Other Articles and Stories Include :

"Banquets and Banqueteers"—Col. George Ham continues his recollections of famous and piquant characters. These reminiscences are being read from P.E.I. to B.C.—and beyond, and attracting scores of interested letters.

"St. Denis and the Plague"—By E. Llewellyn Hughes. A distinctive story of real merit, and a very charming girl.

"The Little Warrior"—By P. G. Wodehouse, has another rib-tickling instalment of generous proportions.

"Orsifer of the Law"—By Archie McKishnie, is another Lenix Ballister story, which shows the swarthy "hero" in a new light.

"Cash and Carrie"—By Leslie W. Barnard, a young Canadian author whose fiction is attracting attention.

"Sketches of Many Premiers"—Mrs. Asquith knew seven Premiers of England—and knew them intimately. There are not many untold secrets in Margot's life.

Review of Reviews Section

Some of the subjects discussed here are :

"Startling Facts from Versailles."
"One Solution of the Servant Problem."
"The New British Empire."
"Cancer Increase and How to Check It."
"The Women of Poland."
"Co-Partnership, the Labor Trouble Remedy."
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"Wealth vs. Love."
"Signs That Show a Man is 'Slipping'."

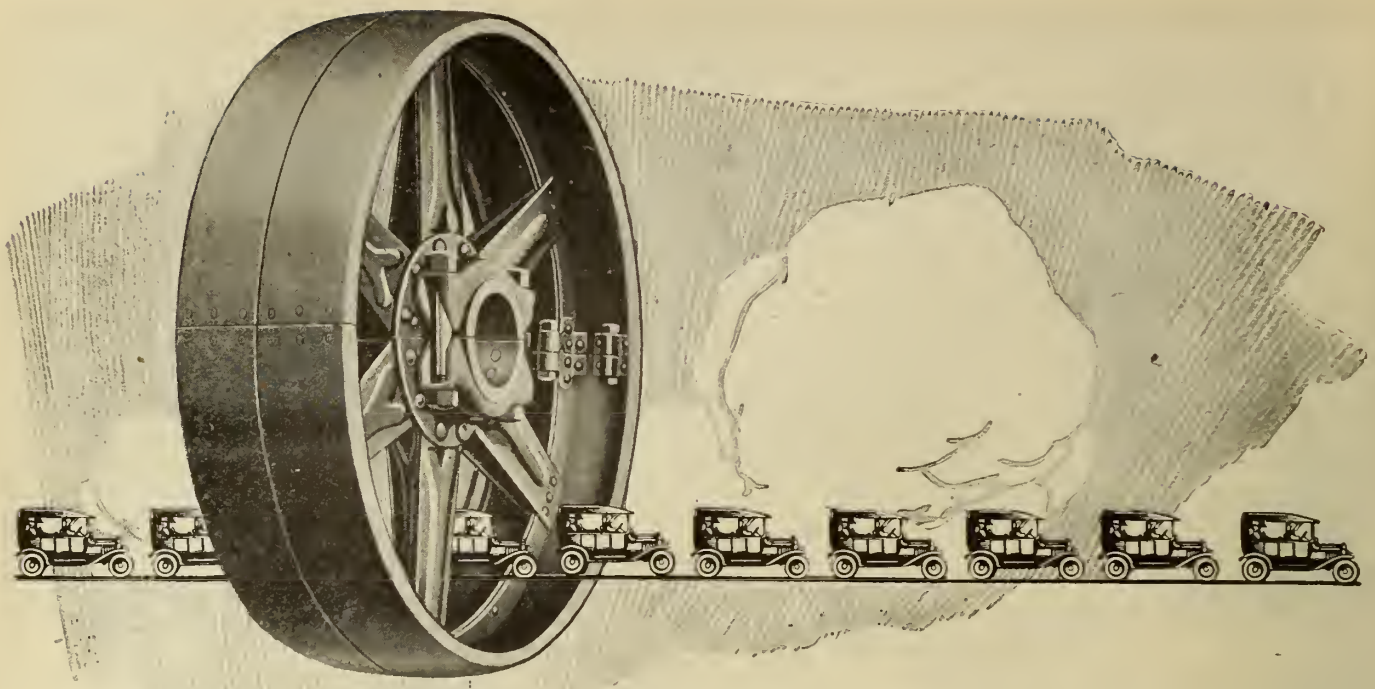
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help make a Ford every five minutes

AMERICAN STEEL SPLIT PULLEYS

A few of the large plants where American Steel Split Pulleys are helping to conserve power:

International Harvester Co.
National Cash Register Co.
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Ford Motor Co.
Cadillac Motor Car Co.
Packard Motor Car Co.
Studebaker Corp. of America
Dodge Brothers
American Woolen Co.
Scranton Lace Co.
Western Electric Co.

There are hundreds of others

IF this were an isolated instance, it might not mean very much to other big power users. But there are just as many "Americans" in use, for instance, in the Cadillac plant. Over twenty thousand in the Western Electric Company's Chicago plant. Several other automobile plants are using from five to fifteen thousand each.

And these efficient pulleys are used exclusively in one of the largest shoe manufacturing plants in the world, the Brown Shoe Company of St. Louis, and in many of the plants of the International Shoe Company.

If the short list of users in the adjoining column were multiplied to include *all* of the great plants that have installed a total of over five million of this one type of pulley, it would be overwhelmingly convincing.

The choice of such prominent manufacturers should justify the prospective user more than anything else perhaps in adopting the "American" Pulley with complete confidence.

It seems inevitable, judged by more than 20 years of progress, that this pulley is to become the standard of pulley excellence.

For name and address of nearest Dealer see Donnelley's Red Book. On file at all leading libraries, national banks and hotels

The American Pulley Co.
Philadelphia, Pa.

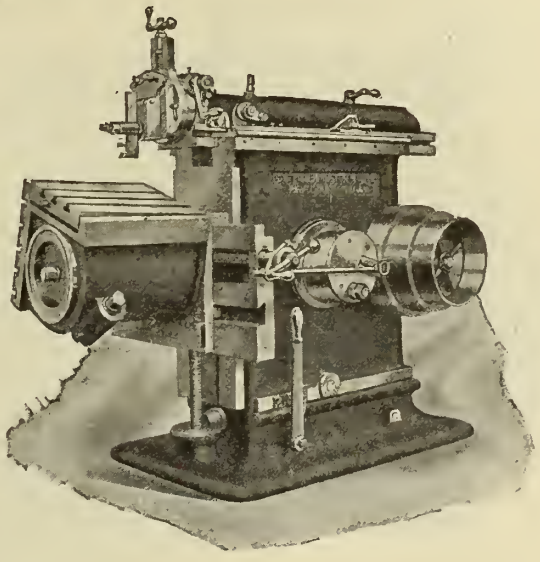
The AMERICAN PULLEY

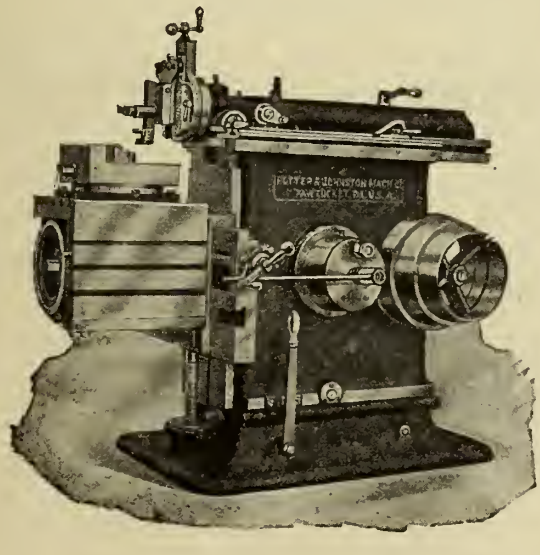
"A wheel with a broad rim transmitting power from or imparting power to machinery, or changing the direction of motion by means of a flat belt."

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Universal Shaping Machines

No special vises or fixtures needed; the Universal features of these machines take care of everything, making them particularly adapted to—
Die Work
Tool Making and
General Manufacturing.





Machines regularly furnished with—

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Auxiliary Tilting Side for Compound Angles.

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Table raised and lowered by power on 24-inch size.

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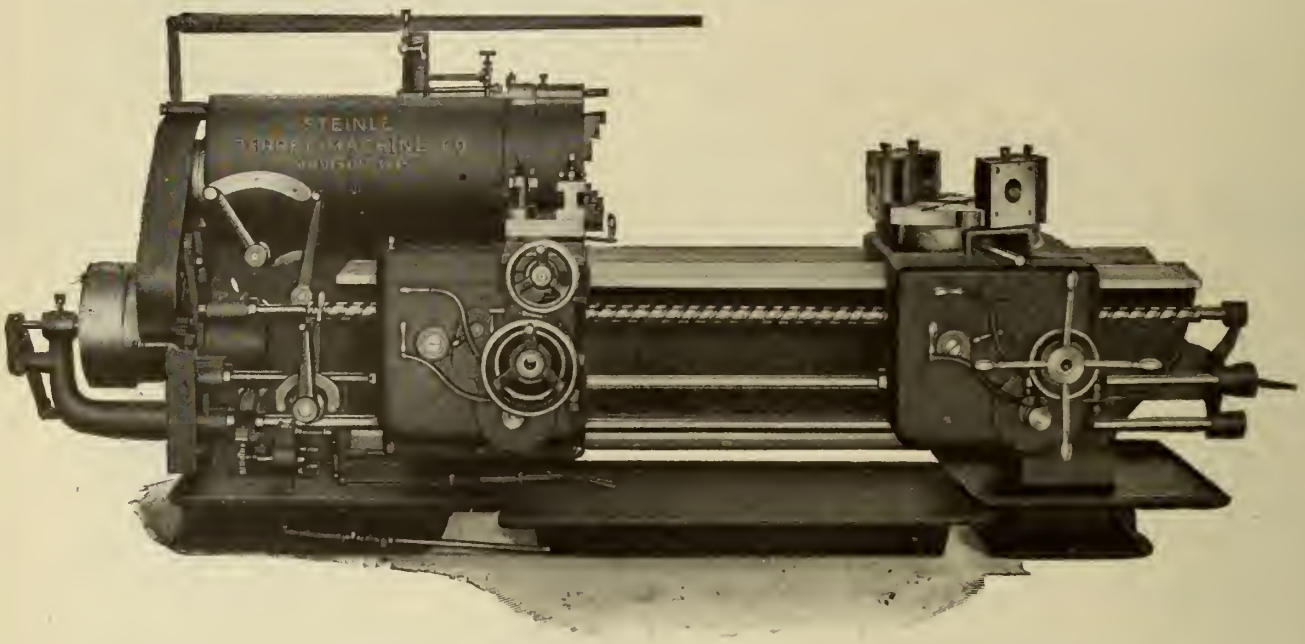
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Full Swing Side-Carriage Turret Lathes



Pre-eminently

A Manufacturing Machine - - - Why?

The first and most important question is one of design, for good design must acknowledge the basic principles underlying the construction of a good machine tool which makes its proper operation entirely satisfactory to those benefiting through its use

To duplicate a wide range of work rapidly, accurately and economically, the machine must have speed sufficient to accommodate all diameters and character of work within the range of the machine, power to pull the heaviest cuts within the capacity of the best cutting steels, reliability to withstand heavy continuous service day in and day out, facilities for simple or extensive tooling equipment, and ease of operation, including power application to feeds and traverses and convenient location of levers controlling the various functions.

These are a few of the superior features of the Steinle Full Swing Side Carriage Turret Lathe.

May we furnish you with further details covering design, or construction of our machine, together with tooling recommendations for the proper production of your work, or ask to have a qualified representative call in order to go personally and thoroughly into the question of what Steinle methods mean as applied to your production questions?

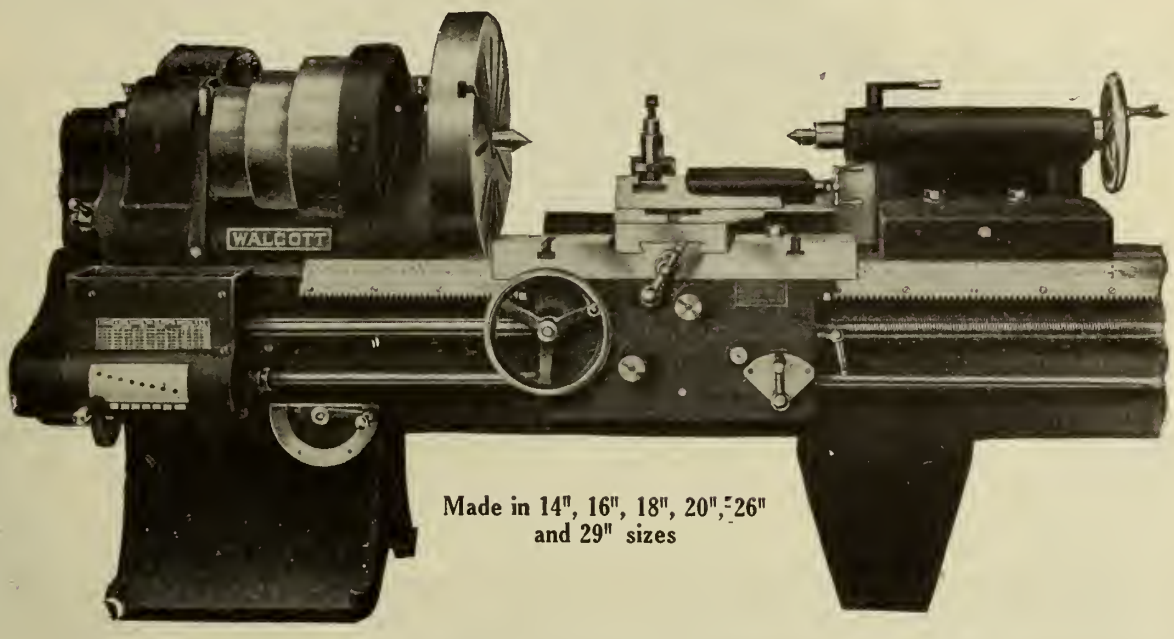
STEINLE TURRET MACHINE COMPANY

MADISON, WIS., U.S.A.

ORIGINATORS OF THE FULL SWING SIDE-CARRIAGE TURRET LATHE

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FOREIGN:—Leo. C. Steinle, 53 Victoria Street, London, England.

WALCOTT



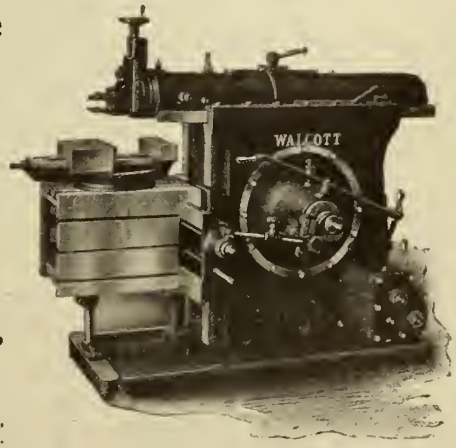
Made in 14", 16", 18", 20", 26" and 29" sizes

A Lathe With a Good Name

When you purchase an engine lathe you naturally turn to one with an established reputation. The **Walcott** has been in the field for 39 years. It is regarded by practical and experienced machinists as a lathe that can be depended upon for **quality** and **quantity** production. The simplicity of its design, strength of construction, high quality of material and finish appeal to the man in shop; he can do his best work on the **Walcott.** Distinctive features are double plate apron, drop forge gears in apron, rigid compound rest, back gears reinforced by one-piece gear guard and headstock, feed gears running in oil, extremely deep bed, large front way on bed and feed rod and screw directly under front way.

Investigate This Walcott Before Buying Your Next Shaper

Every detail in the construction of this **Walcott** Crank Shaper represents the best efforts of the **Walcott** engineering staff to produce a machine that will turn out work accurately and fast. Have us send you a full description.



WALCOTT LATHE CO.

115 Calhoun St., Jackson, Mich.

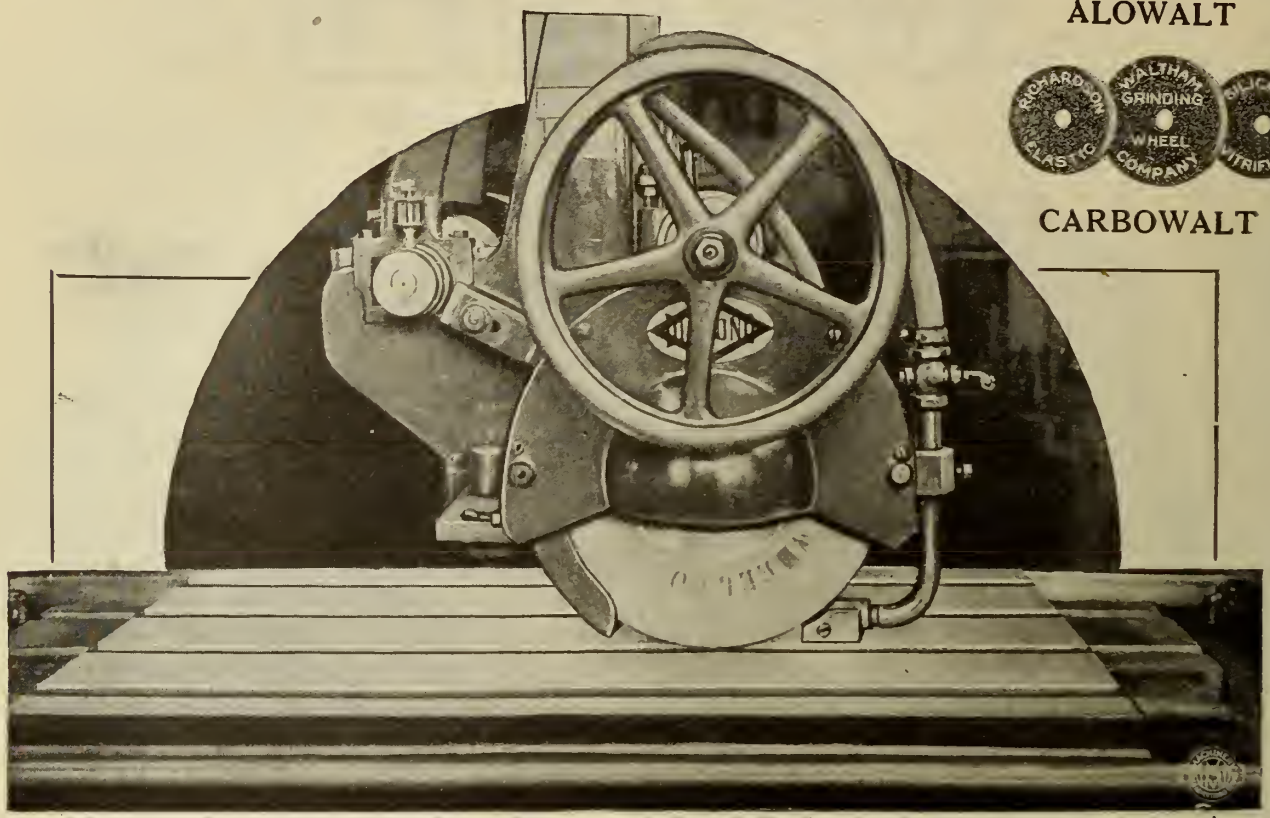
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GRINDING GRINDERS!

ALOWALT

CARBOWALT



Waltham Carbowalt Grinding Wheels

Make Accuracy Economical on Cast-iron Tables for Diamond Surface Grinders

The Diamond Machine Company (Providence, R. I.) guarantee their Diamond Automatic Surface Grinder to work to limits of .0005"; to insure such accuracy infinite care must be taken at every stage in the manufacturing process, each finishing operation especially must be extremely close and accurate. For instance, to insure correct alignment the tables are finished by "grinding in" to the spindle of the machine on which they are to be used. A Waltham Carbowalt Grinding Wheel (No. 36-J) is mounted on the carefully adjusted spindle, the table is put in place and ground to size.

In the operation shown the table was "ground in" to the spindle in two cuts varying from .001" to .0015" in depth, the time in this case was 40 minutes and allowed for several exacting tests.

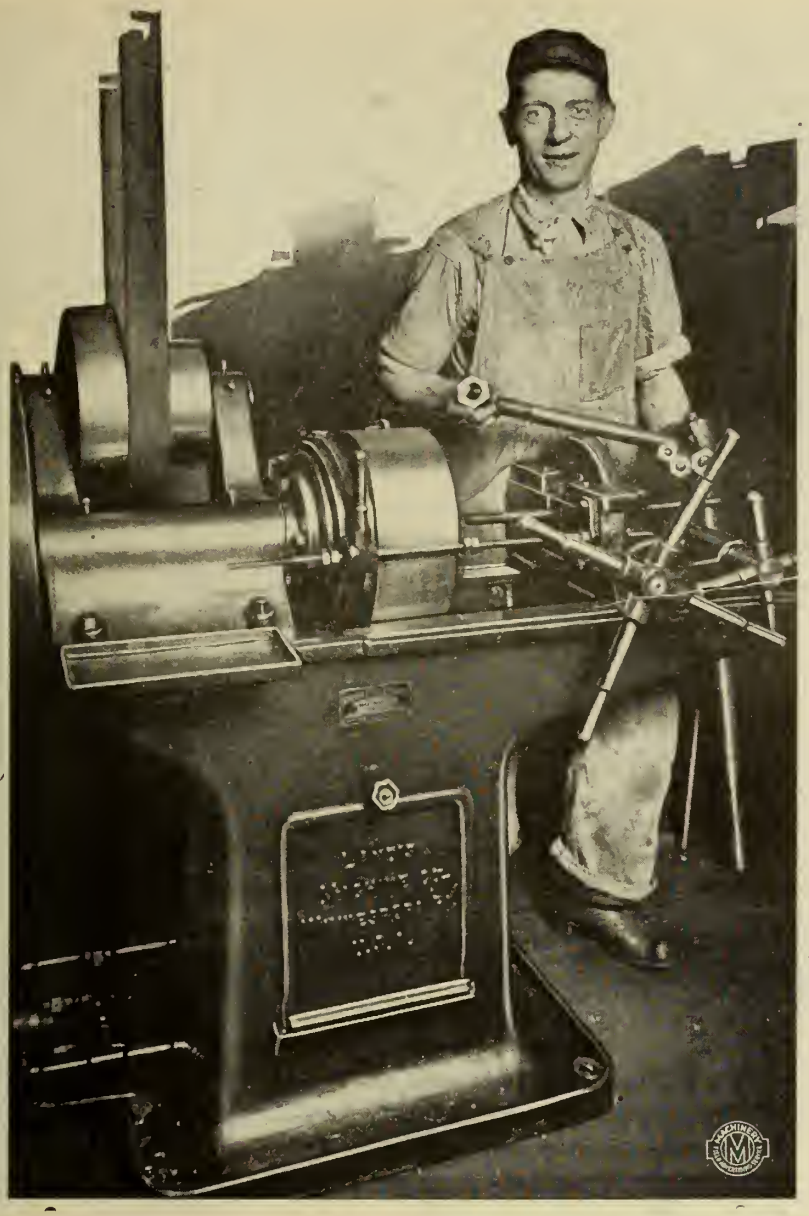
The Waltham Grinding Wheel used for this work has considerable influence on the production time and consequent costs. Carefully graded, to insure the right wheel for every class of work, Waltham Wheels are an important factor in grinding operations wherever they are used.

Describe your grinding work—let us help you choose the correct wheel.

Canadian Representative: STANDARD MACHINERY & SUPPLIES, LTD., MONTREAL

WALTHAM GRINDING WHEEL CO.

WALTHAM MASS., U.S.A.



An Express Schedule Started and Maintained with a

Landis Threading Machine

This bolt and group of nuts take on a new interest when we tell you that they are made of Monel metal. The machining of this tough, hard material has caused much trouble in many shops; but the Rankin Machine Company of Pittsburgh found the solution in the Landis Threading Machine.

The long bolt is 1¼" diameter, thread 2½" long, seven to the inch. Of course, nobody would look for the production on an engine lathe that a threading machine would give, but the difference here is so tremendous that it becomes very significant indeed.

Here is a Comparison of Remarkable Interest

With a single point tool, the time on an engine lathe was half an hour; the Landis handles the job at the rate of one per minute, and gets better, more accurate threads.

Threading of nuts, also of Monel metal, to fit this 1¼" bolt, is done at the rate of seven hundred per day.

Mr. Rankin, superintendent, gives us the following wrinkle for perfect threads on this metal:

The front half of chaser face he grinds back with an acute rake, and leaves the last half with a very slight relief. The perfectly polished thread he gets shows you the value of having a chaser where the rake angle is absolutely controllable so it can be ground to suit the material being threaded.

Ask for the latest Landis Catalog.

Landis Machine Company
Incorporated
Waynesboro, Penn.
U.S.A.

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CANADA FOUNDRIES & FORGINGS LIMITED



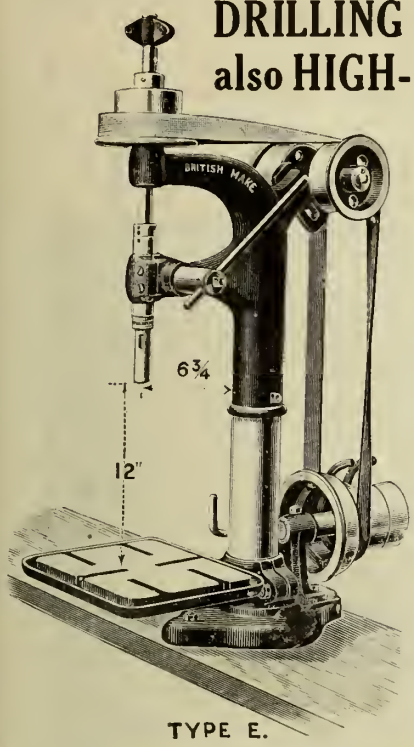
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Imperial Genuine

Made for extra heavy duty, such as Main Bearings on Turbine Generators, Calender Rolls in Pulp Mills, is specially adapted for Marine Engines.



HARRIS HEAVY PRESSURE

THE BABBITT METAL WITHOUT A FAULT

For Donkey Engines, Saw Carriages, Small Motors, Transmission Line Shafting and all steady heavy pressure duty.



Matchless

Suitable For Slow-Moving Bearings

THE CANADA METAL CO., LIMITED
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Heat Under Accurate Control

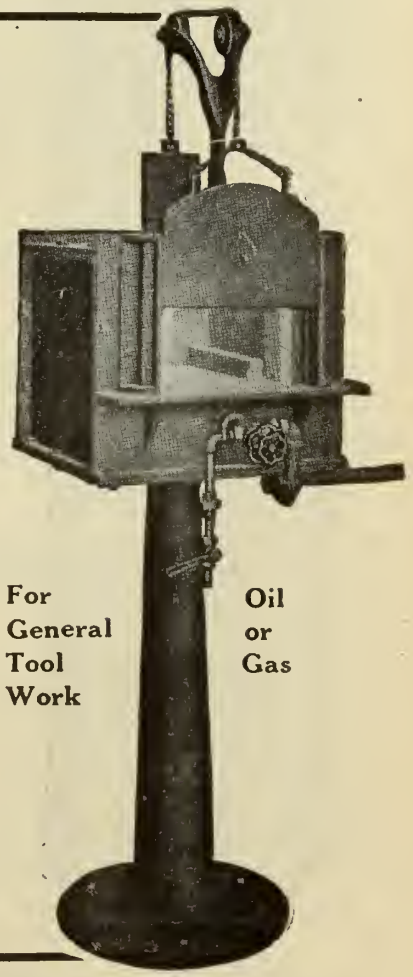
Here is an important factor in the heat treatment of metals. An intense heat, rapidly developed, and always under accurate control of the operator, are features that distinguish

BELLEVUE FURNACES

These tool forges are particularly adapted for the requirements of the small machine shop for annealing and tempering dies, cutters, reamers, etc.

Combustion is perfect and no flames come in contact with material. Built to stand the highest temperature. Doors are properly counterbalanced. In every way BELLEVUE FURNACES meet with the demand for durability, efficiency and convenience.

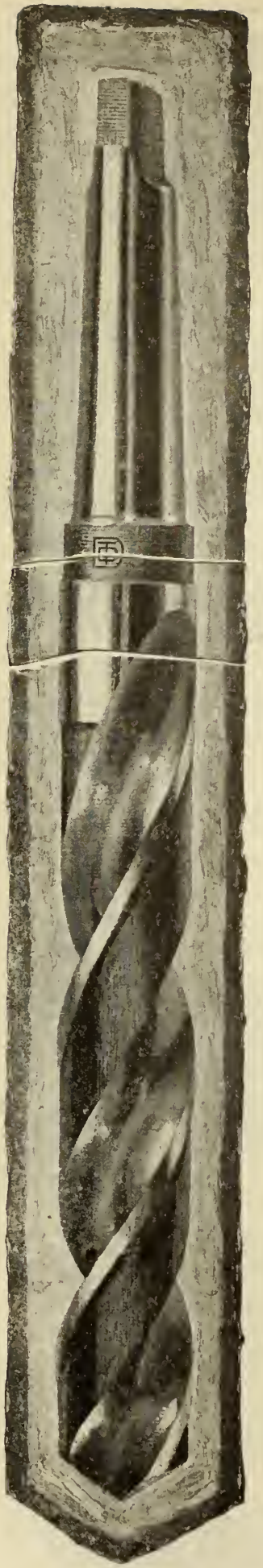
Let us advise you about your heat-treating problems



For General Tool Work — Oil or Gas

Bellevue Industrial Furnace Company
Julius C. Hinz, President
703 Bellevue Ave. - Detroit, Mich.
Representative in Canada: H. W. PETRIE, LIMITED, Toronto, Canada

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ANNOUNCEMENT

WE wish to announce that the Canadian-Detroit Twist Drill Company, Limited, located at Walkerville, Ontario, is now in operation for the manufacture of High Speed Drills and Reamers.

In establishing this business in Canada, we have been able to take advantage of the knowledge and skill in the manufacture of small tools acquired by thirty years' experience, which have gained for the product of the Detroit Twist Drill Company a secure position among the leading producers of the United States.

Our equipment, the careful and experienced supervision of all our manufacturing processes, together with scientific control of quality of raw material, assure the production of dependable tools of the highest quality.

Our stock of High Speed Drills and Reamers will be complete. We solicit inquiries and orders.

CANADIAN-DETROIT TWIST DRILL COMPANY, LIMITED

WALKERVILLE, ONTARIO

—"the best one the Heald Co. has manufactured"

Grind With a HEALD and Be Sure



Getting "Excellent" Results With a Heald No. 20 Grinder

The Continental Piston Ring Co., Memphis, Tenn., are particularly pleased with the work and production the new Heald Rotary Surface Grinder, Style No. 20, is turning out. They have had a great deal of experience with the Heald product and it is their opinion that the latest machine beats 'em all. It is built in two sizes, 8 in. and 12 in. chucks.

The opposite photo shows one of four Style No. 20's removing .009 stock from each side to limits of .0005, turning out 3,000 finished rings per day.

Piston Ring Grinding Requires a Heavily Built and Rigid Machine

Production figures—wheels—methods of holding—circuit breakers—speeds—limits, etc., on grinding rings will be gladly furnished on application.

THE HEALD MACHINE CO.

35 New Bond St., Worcester, Mass.

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LARCUL CUTTING OILS

Save Tools and Time

Don't be quick to blame your operatives when tools go bad. Look to the coolant! Very often a coolant that is supposed to carry off the heat falls down on the job completely. A little extra speed or a little extra hardness of the steel that is being worked, and the temper of the tool is gone! If it had been flooded with Larcul the heat would have been carried off and the tool wouldn't have been ruined.

Larcul also saves valuable time by keeping tools sharp for long stretches. Fewer stops for regrinding. A saving of time that any machine shop foreman will appreciate.

LARCUL AMBER CUTTING OIL—A transparent cutting oil of the highest quality, which, for some classes of work, produces an even smoother finish than can be obtained from lard oil. Gives absolutely satisfactory results on high carbon, vanadium, chrome nickel and tungsten steel.

LARCUL EBONY CUTTING OIL—A dark cutting oil that is unequalled for pipe threading, bolt threading, nut tapping, turrets and automatics, on open hearth, low and high carbon and alloy steels. Many of our customers claim that Larcul gives better results than lard oil.

A demonstration will be to your advantage. No obligation. Write to-day.

Cataract Refining Company
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THE IMPROVED
TAYLOR-NEWBOLD



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Tabor Mfg. Co., Philadelphia, Pa., U.S.A.

1/3 to 1/2 Reduction in Milling Cost

This will be the result of taking small milling jobs from your big millers and putting them up to

The U.S. MILLER

The Miller for Small Work



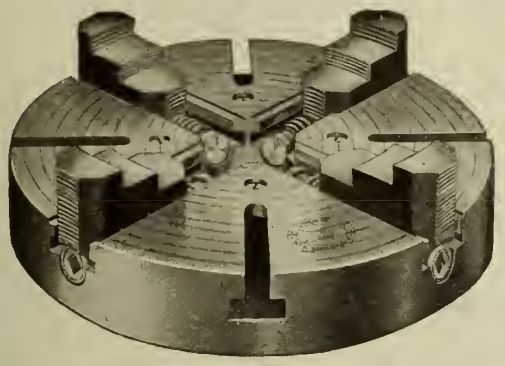
A small machine takes up less space, requires less power, is easier to operate and is more accurate.
The Paramount Miller of its size. Drop us a line for full details.

United States Machine Tool Company
Cincinnati, Ohio, U.S.A.

ALL STEEL

INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



THE UNION STEEL BODY CHUCKS

are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

UNION MANUFACTURING COMPANY

New Britain, Conn.

***New York Office:* 26 Cortlandt Street**

Makers of a complete line of chucks

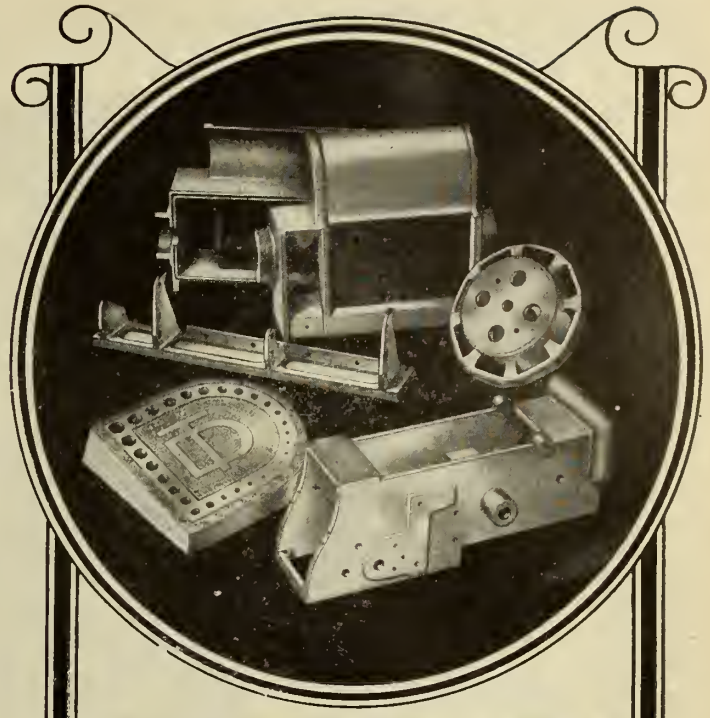


Built For *Service*

This BLOUNT Motor-driven Lathe is well adapted to all speed lathe uses. It is of late design, and has a number of features in which you will be interested. Provided with constant-speed motor. Lathe spindle made of hollow, high-carbon steel, ground to size and bored for Morse taper. Runs in self-oiling bronze bearings.

"We will accept Canadian funds at par"

J. G. Blount Co., Everett, Mass., U.S.A.



FRANKLIN DIE-CASTINGS

They Simplify Production and Reduce Costs

For nearly thirty years Franklin Die-Castings have aided the development of many fields of industry by reducing costs and simplifying production.

Wherever Franklin Die-Castings are adaptable they lower the cost of production through the saving of time, labor, equipment and material otherwise spent in machining.

Franklin Die-Casting methods often make it possible to produce a device in fewer parts. It is through such advantages, derived from the use of Franklin Die-Castings, that many products have been made commercially practical.

In 1892 we originated the die-casting industry. From our long experience, we can advise you whether the die-casting principle can be applied correctly and profitably to your special needs.

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We cast in Aluminum, Tin, Lead and Zinc base alloys. Estimates made from samples, drawings or blueprints.

Send for Booklet

OAKITE

PERFORMANCE

2½ TIMES FASTER

The heat-treating department of a large tool steel factory now removes heavy quenching oil from small steel blocks by means of Oakite materials and methods. Work comes through 2½ times faster—with use of much less sawdust—and every part is absolutely free from oil.

MINUTES INSTEAD OF HOURS

Oakite methods and materials in this plant entirely remove heavy tempering oil from small case-hardened auto jack parts in 12 minutes without scrubbing. Formerly required 24-hour immersion in gasoline followed by hand-brushing of each part. Much time and labor saved.

2 MEN INSTEAD OF 8

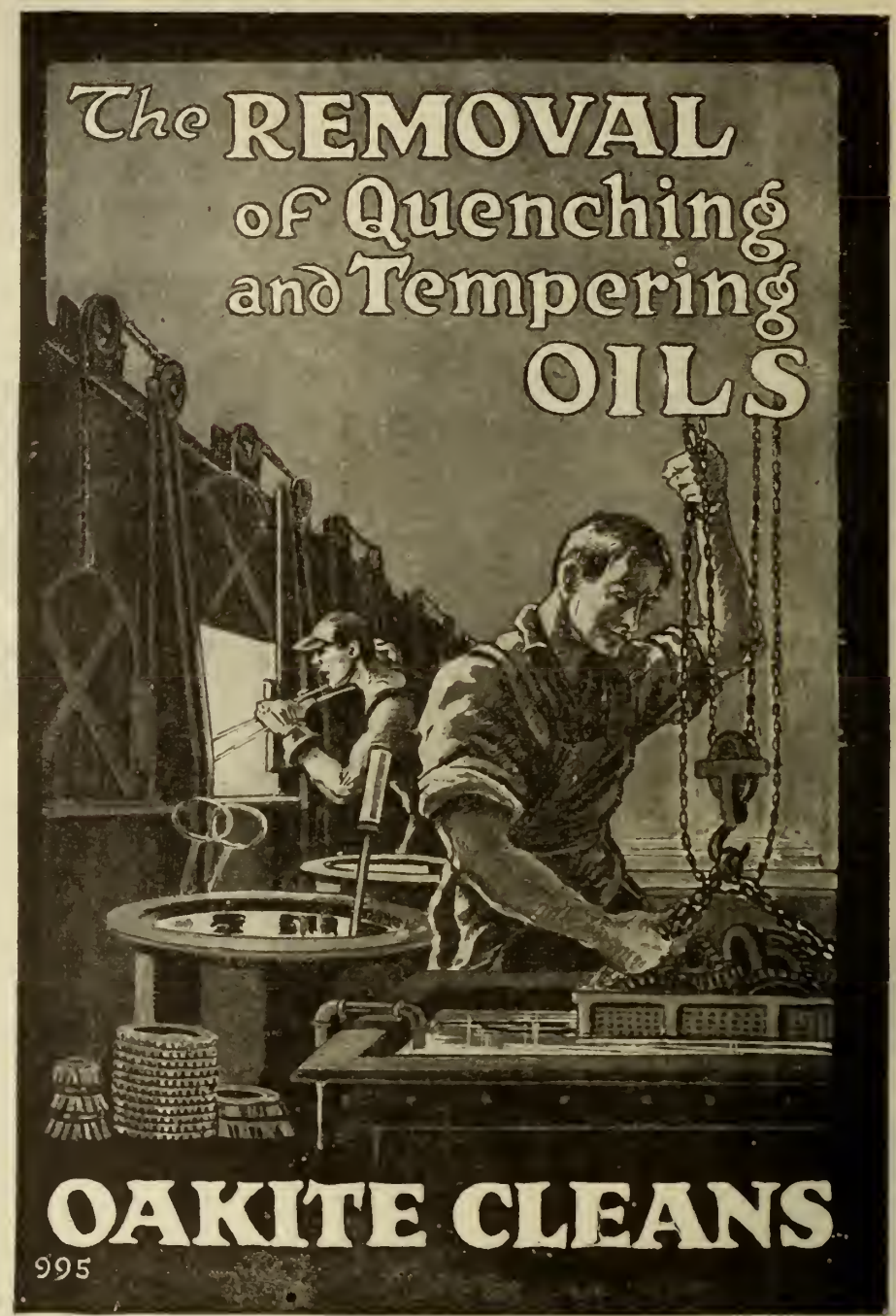
An auto factory now uses Oakite materials for cleaning steel parts before japanning and with 2 men instead of 8 has been able to increase the output of the cleaning room 50%.

ONE MINUTE OIL REMOVAL

In one plant Oakite materials are used to remove quenching oil burnt on reamers and cutters at a temperature of 375 to 400 degrees F., and only one minute is required for each operation. Better results and less labor.

ONLY OAKITE GIVES SATISFACTION

Another plant formerly used gasoline and kerosene for removing burnt-on oil from set screws made for U. S. Government aeroplanes, but could not get good results. Now use Oakite materials and are pleased with the speed and thoroughness with which burnt-on oil is removed.



ASK US TO SEND THIS BOOK—FREE

THIS new booklet—just of the press—discusses the matter of cleaning steel parts after heat treatment. Every plant executive and foreman interested in this class of work should find it profitable to read this booklet. The burnt-on quenching and tempering oils can now be removed with entire success—and economies can be effected in time, labor and money. The booklet tells how.

OAKITE MANUFACTURED BY OAKLEY CHEMICAL CO. 44 THAMES STREET · NEW YORK

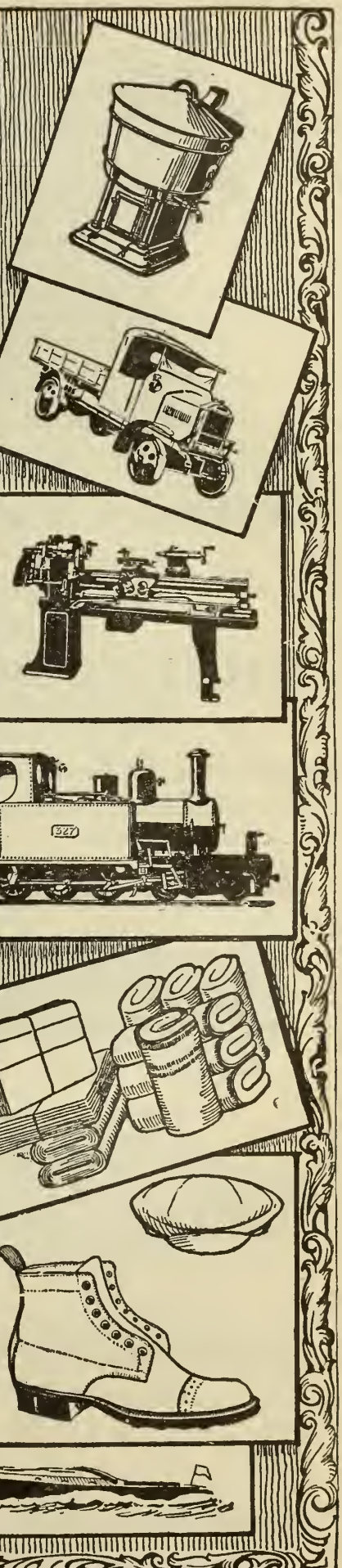
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Have
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Lying in the United Kingdom and
AVAILABLE FOR EXPORT
of
ENGINEERING STORES

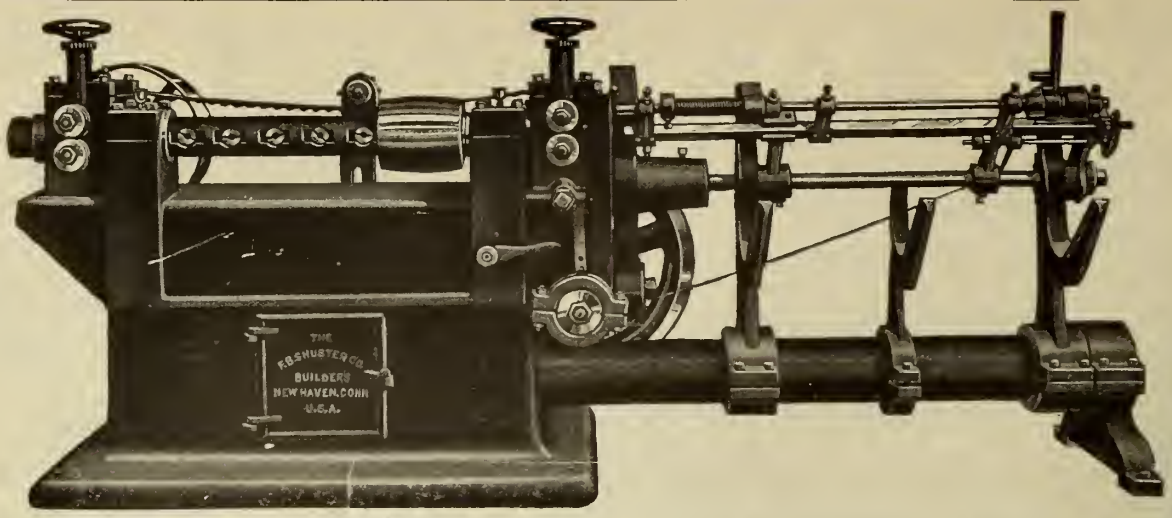
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Just put your coil of wire on the reel, adjust the rolls and dies, and set the gauge for the length you want. The machine does the rest—thousands of feet per day, perfectly straight and cut to accurate lengths.

Catalogue tells more about them, and we will be glad to send you a copy.

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FORMERLY JOHN ADT & SON ESTABLISHED 1886

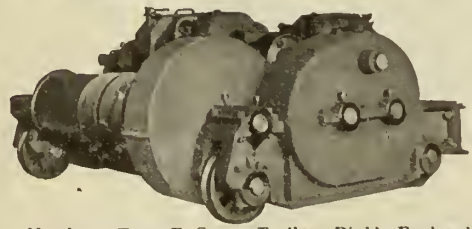
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CANADIAN MADE CANADIAN MADE

Electric and Hand Traveling Cranes

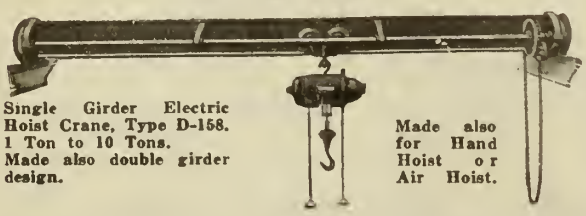


Type E—3-Motor Electric Traveling Crane, 2 Tons to 100 Tons



Northern Type E Crane Trolley, Rigid, Enclosed Construction. Patented in Canada.

We make a wide range of CRANE and HOIST designs. All sizes and capacities, 1 ton to 100 tons.



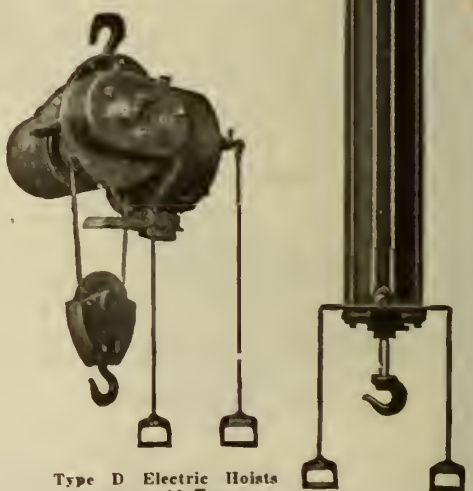
Single Girder Electric Hoist Crane, Type D-158. 1 Ton to 10 Tons. Made also double girder design.

Made also for Hand Hoist or Air Hoist.

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In asking prices, state SERVICE, CAPACITY, SIZE OR SPAN POWER, and, if electric, KIND OF CURRENT.

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Type D Electric Hoists —½ to 10 Tons.

Air Hoists, Trolleys and Tracks.

Type No. 20 Air Hoist.

Northern Crane Works, Limited

Walkerville, Ontario, Canada







New Truths and Old Fallacies

Fusibility of Alloys—*Continued*

Theoretically a shaft rests in the bearing upon a thin film of oil or "floats" upon it, and as long as this condition prevails, the true intrinsic value of a babbitt is masked to a considerable extent; and under moderate speeds and loads a babbitt of most ordinary quality will keep going, but the use of such metals involves a greater degree of wastefulness in power, oil, wear, metal, etc., and they are always on the verge of trouble.

It is most important, therefore, to select lubricants of the proper gravity and viscosity to correspond to the size, load and speed of bearings and that will follow quickly the rotation of shaft and thereby always interpose an oil film; the oil grooves must also be cut to facilitate the flow of oil in the direction of rotation. Metallic contact between the shaft and bearings will invariably cause quick heating, and result in seizing and scoring with most metals. It is under just such crucial conditions that Magnolia Metal proves its real intrinsic worth because of its self-lubricating quality.

For copy of complete article:

"New Truths and Old Fallacies"

Address our Montreal Office

A white metal alloy of any composition will become too soft to support the load if its temperature reaches around 300° Fahrenheit; and the lower its fusibility, the more susceptible it is to the influence of heat and no degree of hardness will protect it, as we shall undertake to show later.

"White Brass"—a tin-zinc mixture—is affected in the same way, under the same heat conditions, only it loses all cohesion and crumbles into small pieces and also has a tendency to seize. These serious faults have limited its use to bearings not likely to heat or that can be cooled by the application of water. It shows desirable qualities when in a cool state, but is most disappointing in actual service and drosses heavily.

Continued next month.

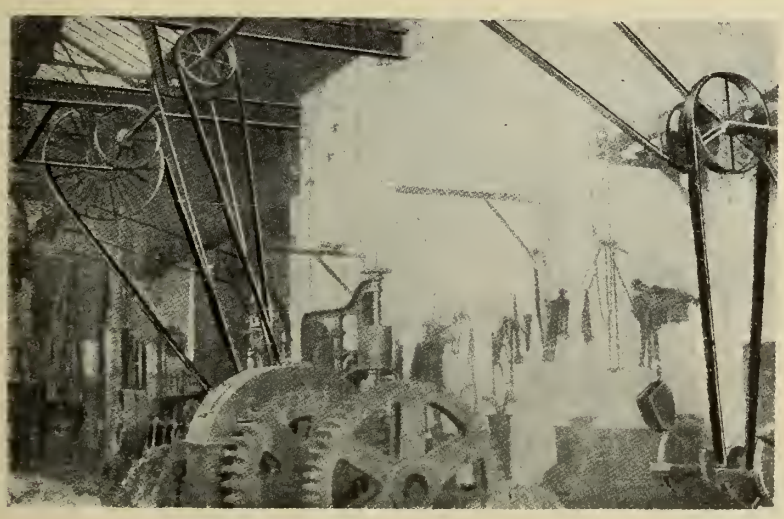
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Office and Factory:

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These beltings will solve your driving problems and save you money.

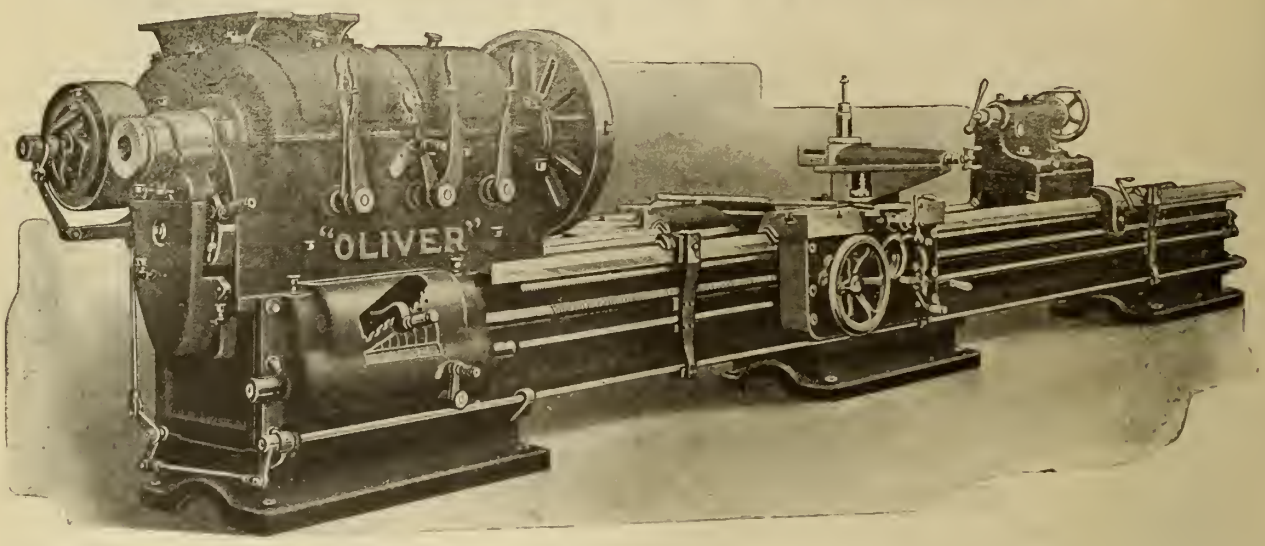
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OLIVER

30-INCH HEAVY DUTY LATHE



"Oliver" Special
36" x 23' 6" Bed Engine Lathe

Built to Render REAL Service

THE Oliver 30" Lathe is exceptionally massive, rigid, and powerful enough to handle the heaviest work with ease and speed.

The headstock is long, heavy ribbed and has unusually long bearing on the lathe bed.

All gears are large pitch diameter, made of cast steel with wide face, fully enclosed and run in oil.

The bed is of exceptional depth and width so that there can be no spring under the heaviest cuts and is so supported on box column legs as to have no overhang.

Many more interesting features of this Oliver Lathe are described in our catalog. Shall we mail you a copy?

Oliver Machinery Company

Grand Rapids, Michigan

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MALLEABLE AND CAST IRON PIPE FITTINGS

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We are equipped to make the general run of malleable and grey iron castings for machinery manufacturers, agricultural implements, automobiles and specialties.

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stamped with our trade-mark mean fittings made with iron of high tensile strength — proper proportions and correct tappings.

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Malleable Fittings

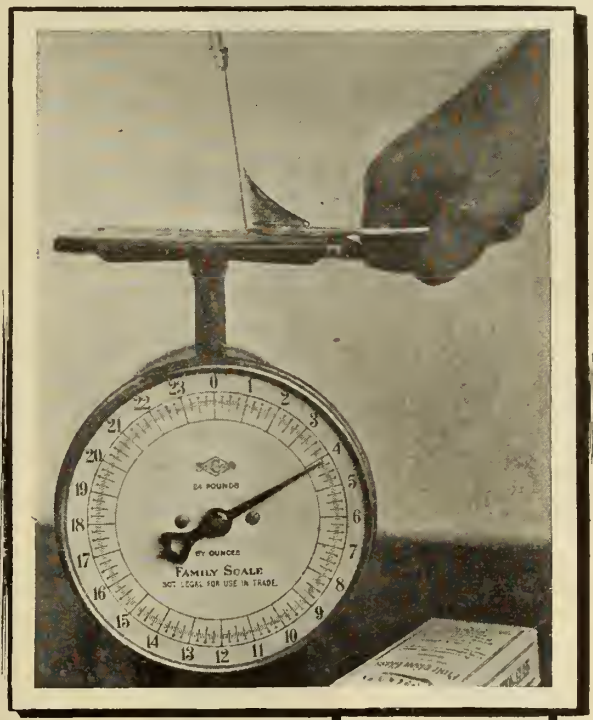
of our brand mean fittings made of *Air Furnace Refined Iron*, reamed and tapped to gauge with perfect threads.

A trial of our pipe fittings will prove the quality of service they give.

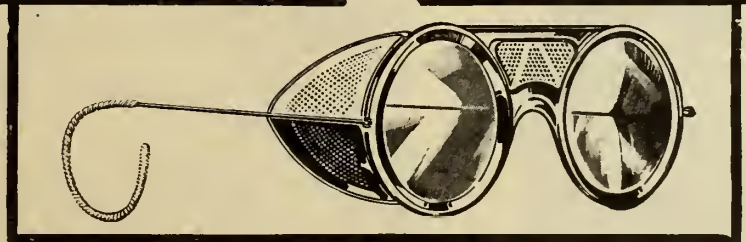
International Malleable Iron Company, Limited
GUELPH, CANADA

You Make These Two Tests of STOCO SAFETY GOGGLES





Test No. 1. Similar to test in proposed eye protection code of Bureau of Standards which calls for 4 lbs. pressure without permanent distortion of frame. Unretouched photo—shows STOCO Safety Goggle standing 7 lbs. pressure.



Test No. 2. Similar to test in proposed eye protection code of Bureau of Standards which calls for 8 oz. pressure without permanent distortion of frame. Unretouched photo shows STOCO Safety Goggle standing 4 lbs. pressure.

These two tests, which anyone may make, show conclusively the strength and rigidity of the one-piece front construction of the STOCO Safety Goggle and indicate the service this protection glass will give under the abuse of shop wear.

In spite of this unusual strength the STOCO Safety Goggle is no heavier than other protection glasses of much less substantial construction and may be worn long hours at a stretch without discomfort.

If you are interested in and responsible in any way for the prevention of industrial eye accidents ask us on your own—or your firm's—letterhead for a sample STOCO Safety Goggle. There will be no charge.

Price per Hundred.
(F.O.B. Geneva, N.Y.)

With Optical Glass Lenses	$90.00
With Celoglas Shatter-Proof Lenses	$115.00

Easy cable earbows or black elastic headbands at same price.
Discounts for quantity orders.

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BERNARD
Wood Split Pulleys

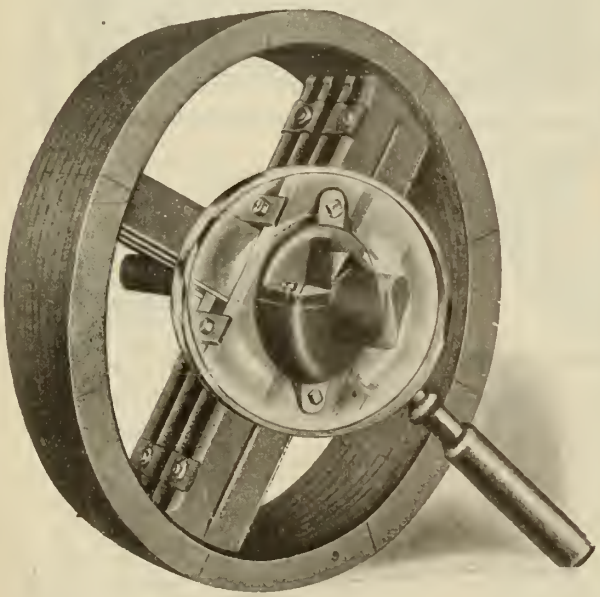


Save Power

Wood Split Pulleys are lighter and they have an efficient Belt Gripping Surface

With the installation of Bernard Wood Split Pulleys you start on the road to lower overhead. Their cost is low.

Safety **Satisfaction**



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STEEL CASTINGS

We shall be glad to supply information on:

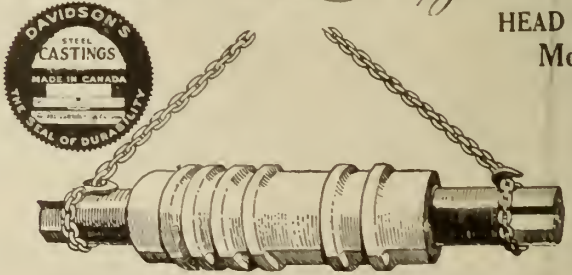
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Lachine Cana Turcot

DAVIDSON

Locomotive Cylinder or Dome Facing Machine

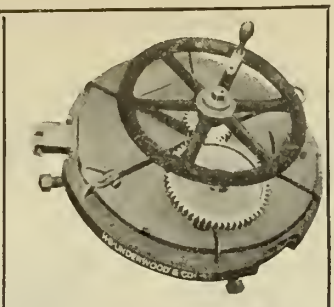


Illustration shows our latest Locomotive Cylinder or Dome Facing Machine. This tool embodies many improvements and has been pronounced very satisfactory by its many users.

All working parts are covered and easily oiled. Gearing is all cut from the Solid. When working the clutch is thrown in by moving the lever with clutch pin attached (shown in cut, on top near the hand crank) and the machine will feed automatically. Made in sizes to suit requirements.

Taper socket can be furnished to take the place of hand wheel for air motor drive.

When ordering give the inside diameter of the work for which they are wanted. Details on request.

H. B. UNDERWOOD CORPORATION
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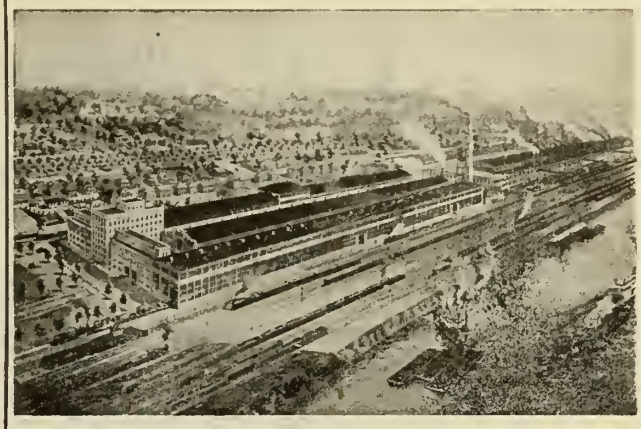
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Your
Machinery-Tools-Shop Supplies



Above is shown our Windsor store and Manager John Doherty.

Mr. Doherty has surrounded himself with a capable organization whose chief aim is to give the very best possible service.

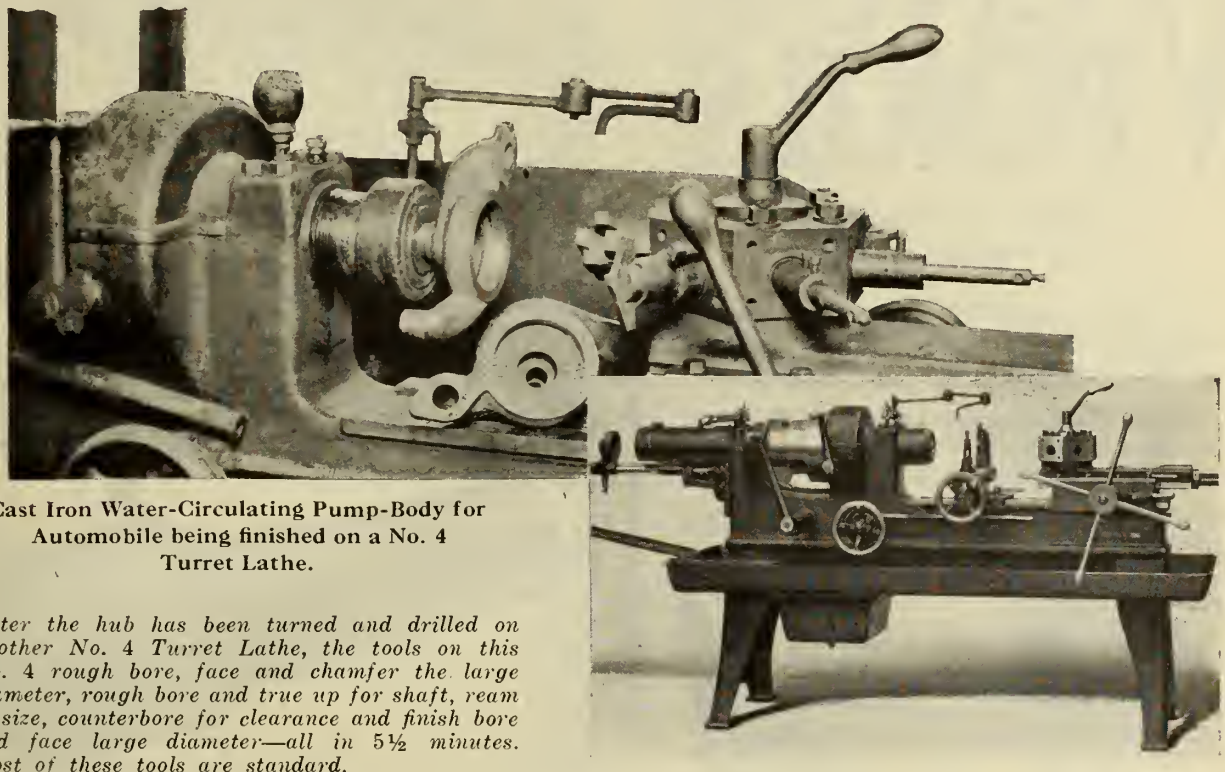
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"Everything for the Shop"

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Profit by this Temporary Lull



Cast Iron Water-Circulating Pump-Body for Automobile being finished on a No. 4 Turret Lathe.

After the hub has been turned and drilled on another No. 4 Turret Lathe, the tools on this No. 4 rough bore, face and chamfer the large diameter, rough bore and true up for shaft, ream to size, counterbore for clearance and finish bore and face large diameter—all in 5½ minutes. Most of these tools are standard.

This breathing space for re-adjustment can be made very profitable. It's a time to study the things you have been doing to discover easier, quicker and more economical ways of doing them.

Changing a tool or two on a turret lathe; combining operations which the turret and carriage can do simultaneously; or, it may be adding a multiple cutting tool will increase your production materially and bring down your costs.

Let us send one of our engineers to consult with you about turret lathe practice. We've had forty years' experience making and tooling turret lathes.

The Warner & Swasey Company
CLEVELAND, U.S.A.

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Engineers everywhere use the perfect VENUS knowing that none other gives the same supreme service and satisfaction.

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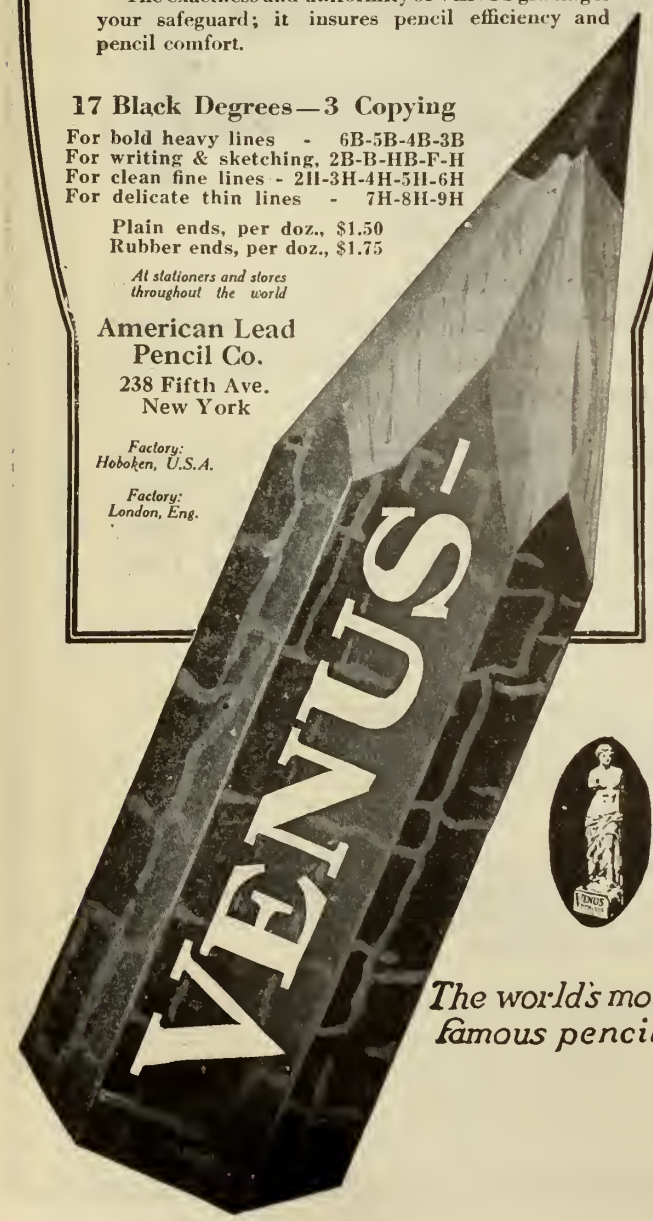
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Factory: Hoboken, U.S.A.

Factory: London, Eng.



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We wanted something original—this is what we got

"BOTH of these operations and half another — I'll show you later—completed in the time our old taps took to do one; that, I guess, is why we continue to use your Victor Collapsible Taps."

It was the often-heard story of time saved, of costs lowered, of all threads clean and smooth. And it was pleasant to hear.

Victor Tool Company
Waynesboro, Pa.
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We have been making springs of all kinds for 70 years. Let us advise you when in difficulty.



Tell us the purpose for which the spring is intended, and experts will gladly co-operate to see that you get the design best suited to the purpose.

Dunbar Springs are thoroughly tested for accuracy and quality. Send us specifications, for estimates.

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HIGH SPEED STEEL
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Tool Steel for Every Purpose
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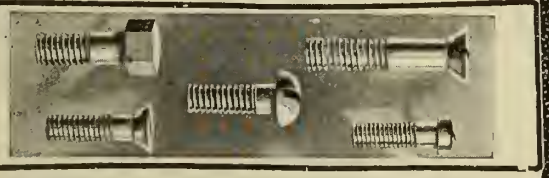
Twist Drills, Taps, Hack Saw Blades, Milling Cutters
Files, Etc., Music Wire for Springs, Steel Balls.
Cold Rolled Tool Steel in Strips and Sheets
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SEND FOR CATALOGUE
Series



For sixty years we have constantly manufactured machinery for making screws, always studying to improve and refine our product.

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Asa S. Cook Co.
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Canadian

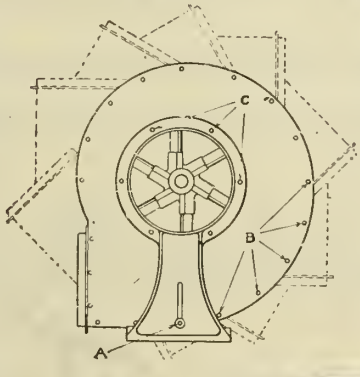
The Canadian Standard Reversible Mill Exhauster will keep your shop clean, remove sawdust, shavings, fumes, gas or any loose materials and disagreeable odors.

Insurance rates can be reduced; floors and machines covered with sawdust, chips or shavings, increase the fire risk.

Insurance companies reduce the premiums where adequate precautions have been taken to prevent fires.

Blast Wheel — This wheel is so constructed that it will handle any kind of stringy material efficiently, such as sawdust, shavings, cotton lint. Will also handle gases, fumes, smoke, etc.





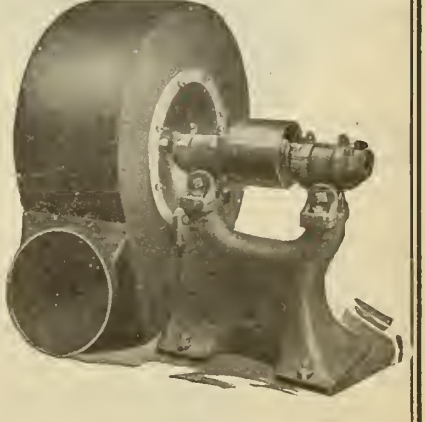
The Canadian Standard Planing Mill Exhausters have reversible housings so that the outlet can be adjusted instantly to any angle desired.

This eliminates necessity of crossed belts. Simplifies changes on alterations in piping or building.

The housing is of heavy rolled steel plate securely bolted together with angle irons. Round cast iron outlet bolted to the housing. Blast wheel mounted on heavy cast iron spider.

Every fan carefully tested by running test at speeds in excess of that required.

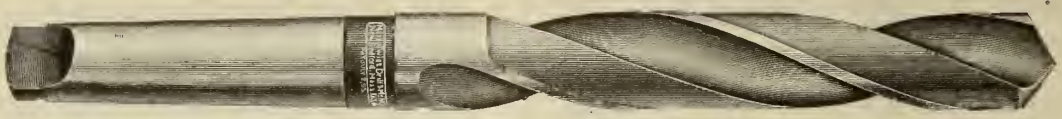
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Canadian Blower & Forge Co.
Kitchener, Ontario

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The Genuine "MORSE" DRILLS



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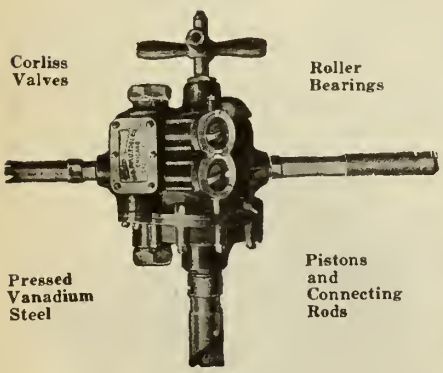
Increased Production

First, Last and All the Time
And Are Known the World Over for Their

Uniform Quality and Dependability

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Four cylinder type, two on each side. Semi-Corliss valve close to each pair of cylinders gives greater efficiency and power, saves clearance losses and allows air to enter cylinder at full pressure of the pipe line.

One Piece Long Stroke Riveting Hammers. No coupling.



One Piece Construction—No leaky joints. Solid Balance Valves—No holes to plug with dirt. Direct Exhaustion — No grit returned through valve.

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Thor

The Tools that Reduce High Cost of Labor

Manual labor was never so costly as it is to-day. You are running into needless expense if you continue work with hand tools when ONE man with one **T h o r** pneumatic tool will do FIVE TIMES the work.

The demand for **Thor** pneumatic drills, hammers, grinders, rammers, electric drills and grinders, increases daily. Their economy, efficiency and superiority in practical service is widely recognized. You should adopt them without delay.

Our Catalog contains valuable information—
Yours on request

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STEEL PLATE

—IN—

Universal Edge - up to 40 in. wide

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Any Thickness **Any Lengths**

Send Us Your Enquiries.

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Greenfield

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will greatly cut the cost of your small cylindrical work within the limits of 4 x 12 inches. Equipped with small grinding wheels for taking light cuts with great rapidity, they require only a minimum amount of power.

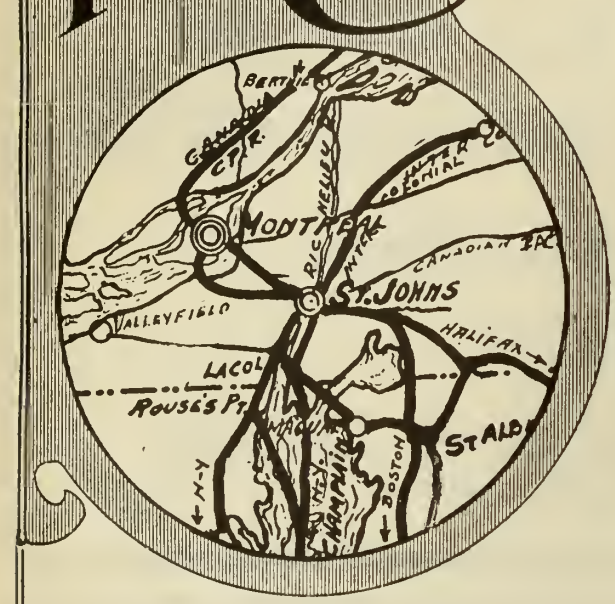
Greenfield Plain Grinders are strong, accurate, medium-weight machines capable of giving any degree of speed without shifting belt or changing gears. They grind small standardized parts with efficiency and dispatch.

It will prove worth your while to investigate their many other money-saving features. Write to-day for particulars of this money-saving grinder.

Greenfield Machine Co.
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Offers To Manufacturers—

A Cash Bonus On Your Payroll, Exemption From Taxes, Etc.

Already a busy industrial centre, St. Johns is rapidly expanding and now offers unparalleled inducements to encourage the establishment of new industries.

Every new industry is exempt from taxation for a period of fifteen years, such period being subject to extension. A bonus of 5 per cent. will be paid on your payroll for a period of five years. If you desire it, the city will advance this to you to be applied to the purchase or erection of any building suitable to your purpose. All public improvements you may require, such as street extensions, sidewalks, waterworks and sewage will be attended to by the city.

In addition to these inducements, St. Johns enjoys one of the finest industrial locations in Canada; has unequalled transportation facilities, an adequate fuel, power and labour supply, making it an unusual industrial opportunity.

No Other City Can Offer These Combined Advantages

Seven railroads, including Canada's great transcontinental lines.

Finest ocean shipping facilities.

Canal connections with New York, the Eastern States and the Great Lakes.

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Plentiful supply of skilled and unskilled labour.

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Desirable factory sites with all public conveniences immediately available.

Extraordinary inducements to new industries.

For more specific information write to

The Secretary of the City Council

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THE MASTER METAL ■ THE MASTER METAL

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Increased Production 26%

For speed cutting Stellite is supreme. It will cut **any** metal much faster than the finest high speed steel—the difference in speeds runs as great as 1,000% on some metals!
Here is a table which will show what Stellite accomplishes for one manufacturer:

Classification	Tractor Engine
Part	Piston
Material	Semi-Steel
Operation	Rough Turn, Groove and Face
Lubricant	None
Tool	¾″ sq. x 6″ and ⅜″ x 1″ x 8″

Description —A ¾″ sq. No. 3 Stellite tool is used for turning O. D. and 4⅜″ x 1″ x 8″ No. 3 grade tools are used for grooving. A ½″ sq. x 4″ No. 3 grade Stellite tool bit is used for facing end.

Average Time

Stellite ..... 6 min. H. S. S. ....8 min. 20 sec.

Number Between Grinds

Stellite .....80 H. S. S. 20

Production Increased Over 26%

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THE MASTER METAL ■ THE MASTER METAL

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Announcing



the issuance of a new catalog of prime interest to all users of milling and gear cutters and small tools. Herein you will find listed styles and sizes of end mills (special and plain) T-slot cutters. Key cutters, thread mills, gear slots—in fact your needs in the small tool line of this class are sure to be covered. Get your copy and note its completeness.

If your special requirement doesn't appear, Bilton can produce it—and in true Bilton Quality.

Just sign your name and address on a card and post it to

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Housatonic Ave., Bridgeport, Conn.



—as a matter of course

Lifting and carrying is but an incident in your manufacturing operations. Your men accept it **as a matter of course.** In holding a bar of steel for the drop forge, or loading a case onto a truck, the chain hoist must be dependable, for the men are not **expecting** trouble.

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Any size, up to 20 tons—and more—can be provided. Also worm-gear and differential hoists, and special types for special requirements. Full information will be sent in response to your letter.

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Pumps for pulp and paper mills, Pumping Engines for municipal purposes, Centrifugal Pumps.

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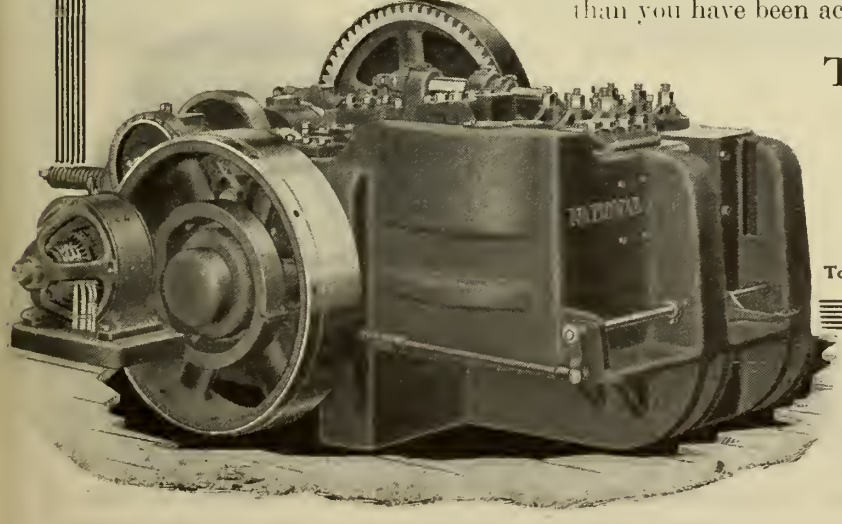
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This hub forging is for motor truck wheels, and the finished hub is 6½ inches diameter. The stock used is 2⅝ inches round and the job is forged and punched off the bar in three blows of the machine. There is no waste, the wad remaining a part of the bar.

Close dimensions are maintained and little machining is expended in finishing the hub.

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Canadian Representatives:
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For, in addition to wasting fuel by destroying at least 25 per cent. of your power, hangers with plain bearings demand frequent renewals, require heavier belting, have an unusually high maintenance cost, and are very wasteful of lubrication.

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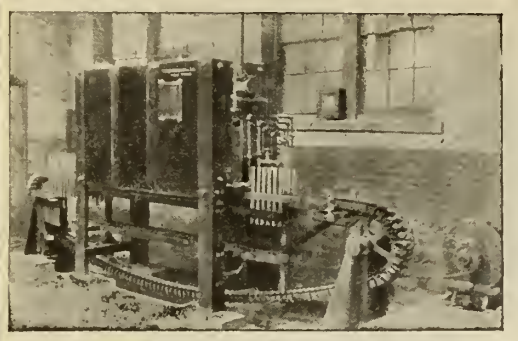
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An example of "Quantity Production of Quality Product" made possible by use of Automatic Furnace.

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Will they help ME?

That depends on the kind and quantity of material you handle per day, the regularity of its flow, layout of plant and machinery, fuel available, etc.

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Write for copy of Bulletin to

Canadian Representative

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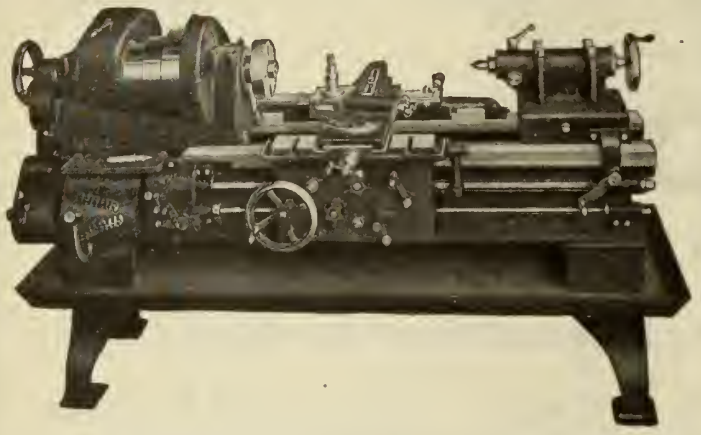
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"Furnace and Fuel to Suit Conditions"

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Will Put the Same Degree of Efficiency Into *Your* Shops as They Have in Many Others



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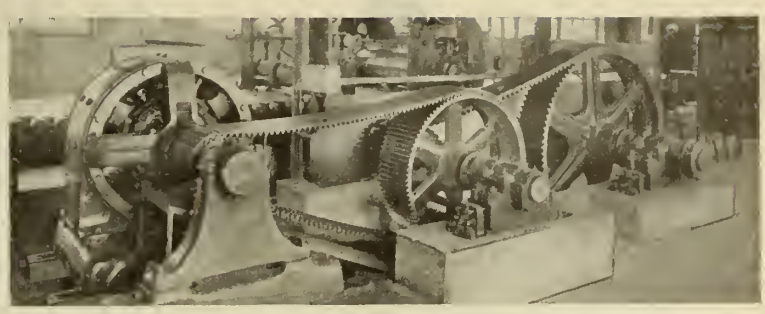
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For the
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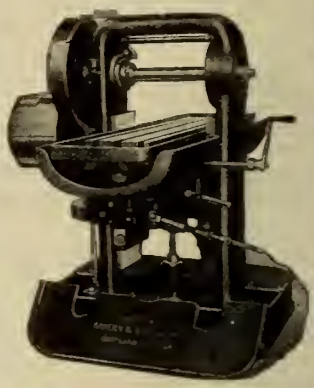
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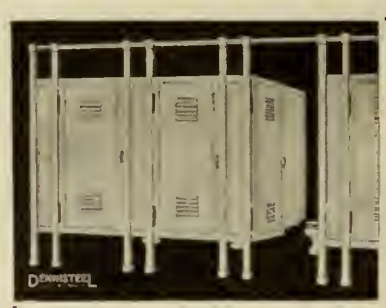
No matter what the nature of the work or how severe the service the Briggs Miller will stand up to it. Its unusual rigidity, great strength and ability to take wide deep cuts when running at a high rate of speed, has established a wide reputation that is unexcelled. We would like to show how "Briggs" adaptability and convenience can increase output and lower costs for you. A letter will bring full details by return mail.



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We have concentrated our institutional brains on

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Lavatory Compartments
"Hygienic—Fireproof—Non-Markable"

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They can be enamelled to harmonize with the most elaborate fixtures or decorative effects.

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if your variety of grinding is large invest in a Manhattan Universal Grinder. It is capable of handling cylindrical or internal grinding with the utmost in speed and accuracy.



Manhattan All-Around UNIVERSAL TOOL GRINDER

Write for details.

Manhattan Machine & Tool Works

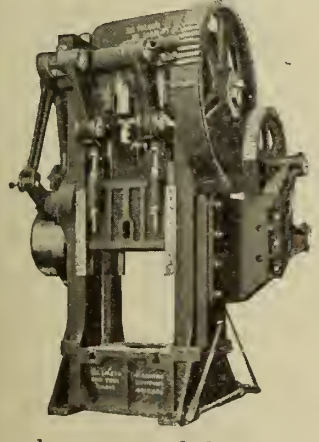
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in all sizes, from the smallest to the largest, in both the single and double crank types.

Their Superior Merits Have Been Recognized

by many of the largest press users.

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Estimates Furnished

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The Nationally Known—First Quality

HIGH SPEED STEEL

is the best for all Machine Work

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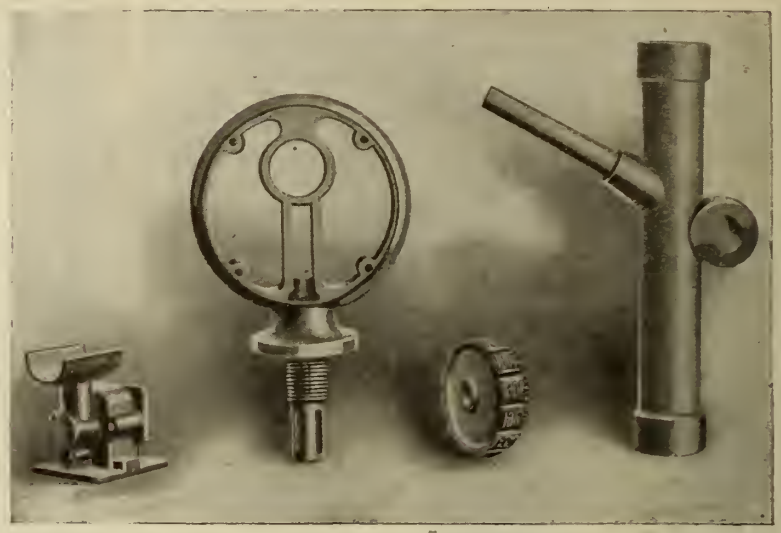
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Have Your Castings

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GEAR teeth, threads and numbers can be cast so perfectly by the Die-Casting process that no machinery whatever is required. If you are using parts in quantities don't you see where it will pay you to have them die-cast? This method of production is a success. It has been adopted for use in many plants. Don't put it off any longer! Join the ranks of those who are having their quantity parts Die-Cast.



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WHY waste time and energy with makeshift devices for boring operations when Williams' "Agrippa" Adjustable Boring-Tool Posts offer convenience and efficiency developed to the *n*th power.

Each Post accommodates a wide range of Bars, the height of which is readily adjusted; a turn of the Knurled Ring raises or lowers the base on which they rest. The whole device is instantly and rigidly locked by tightening the Set Screw.

Four sizes for ½" to 2¼" diameter Bars—furnished with or without Bars.

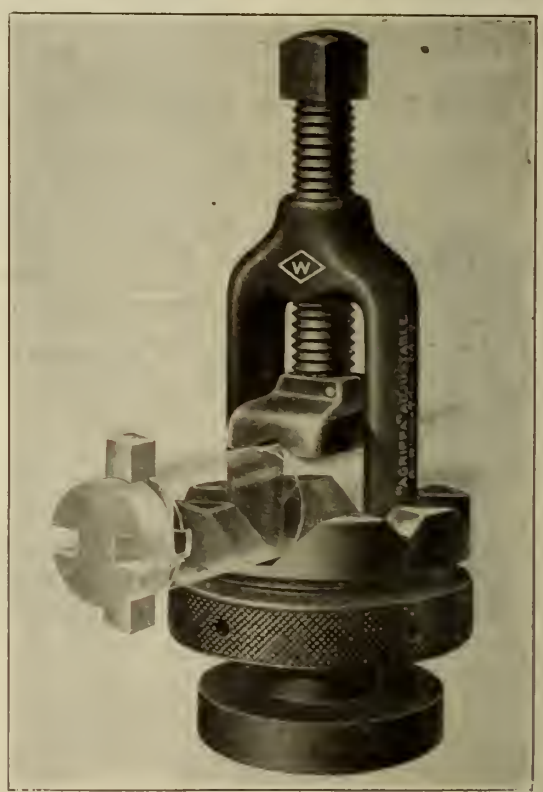
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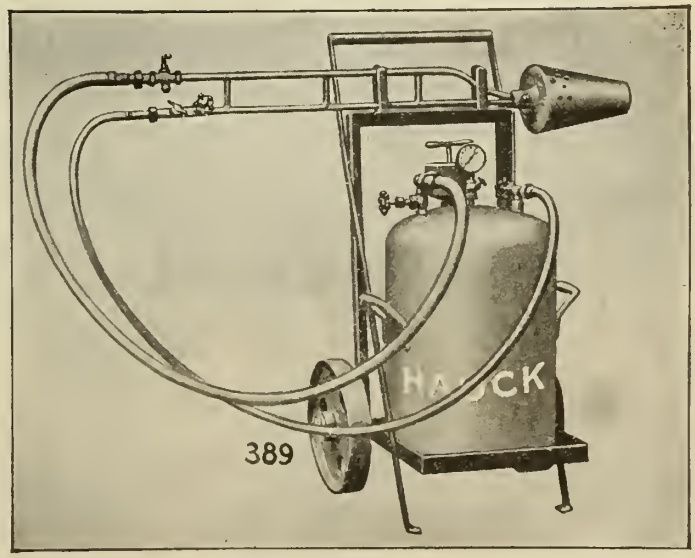


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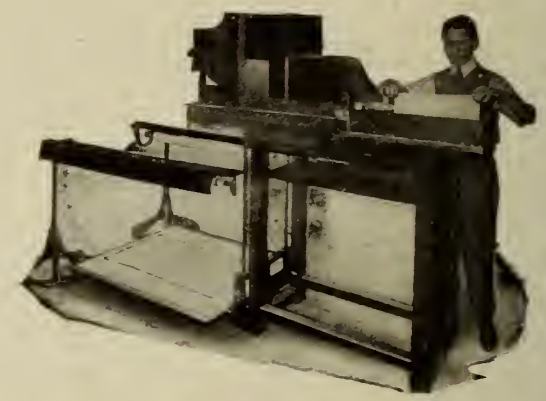
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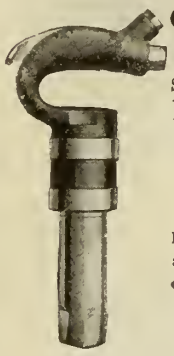


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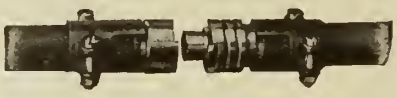
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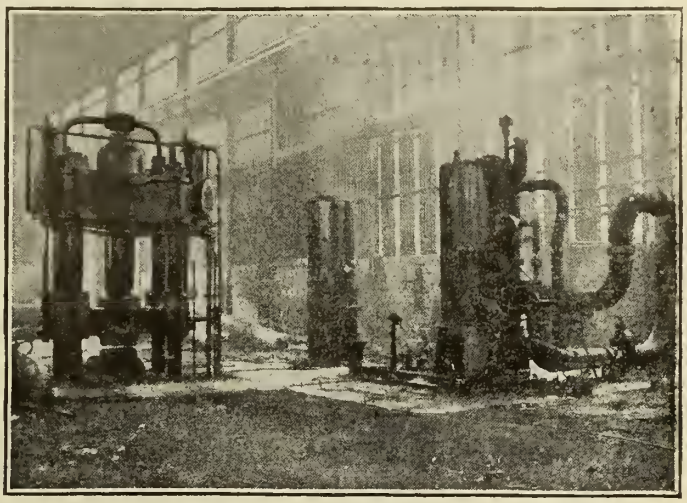
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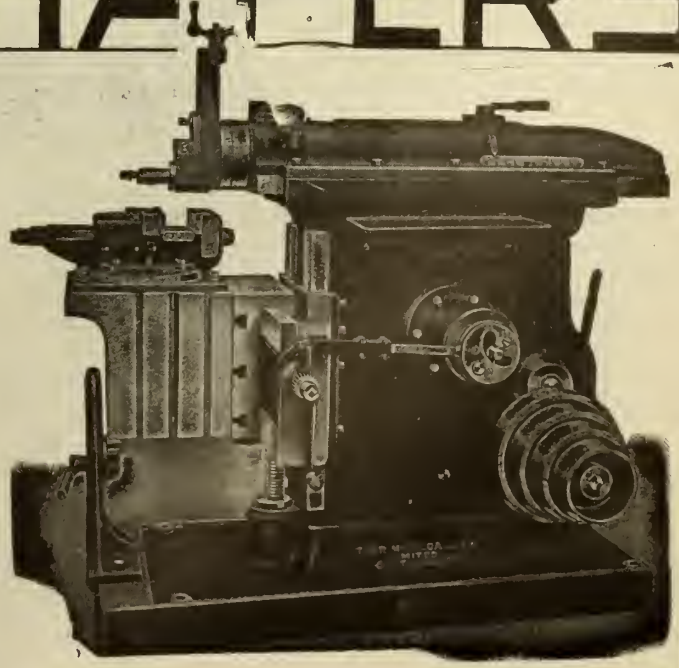
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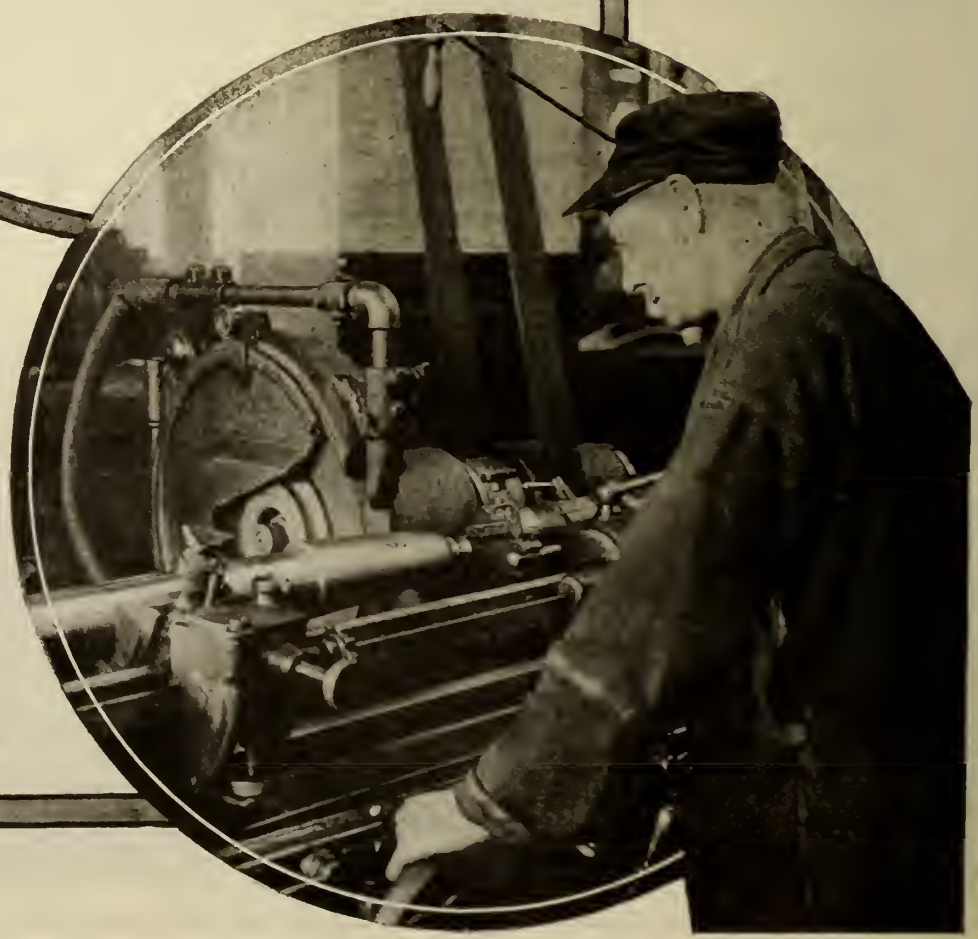
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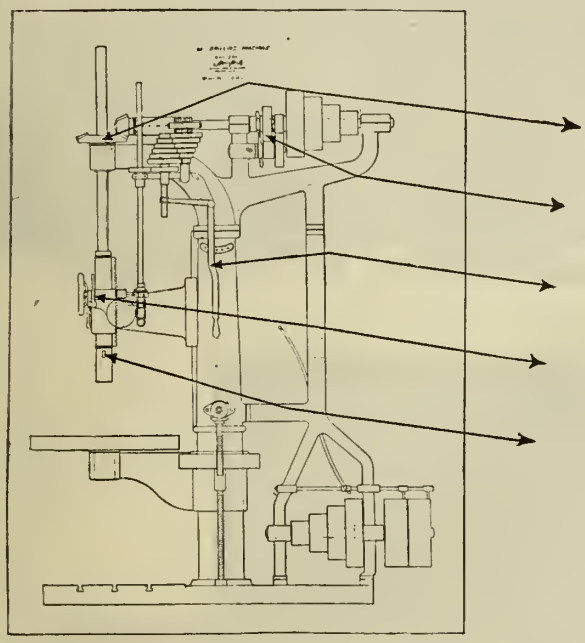


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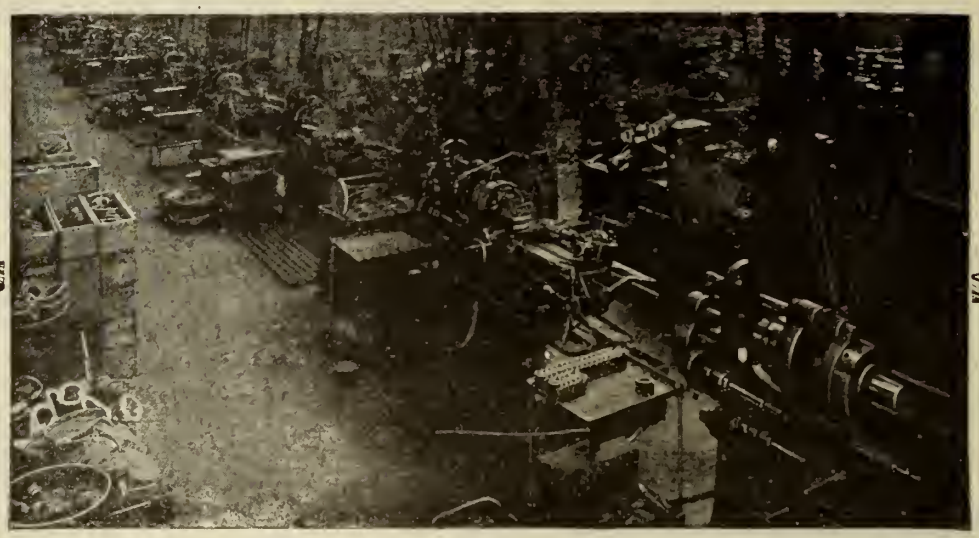
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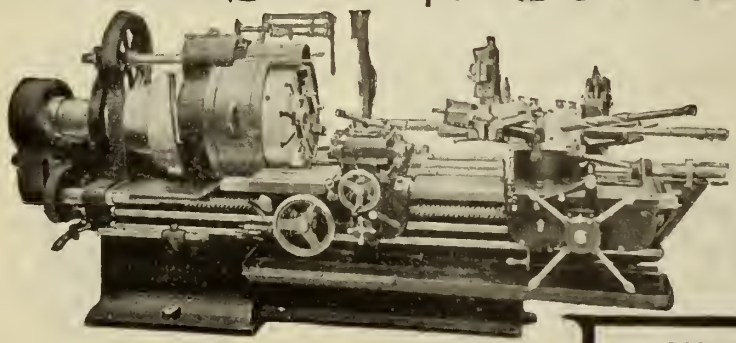
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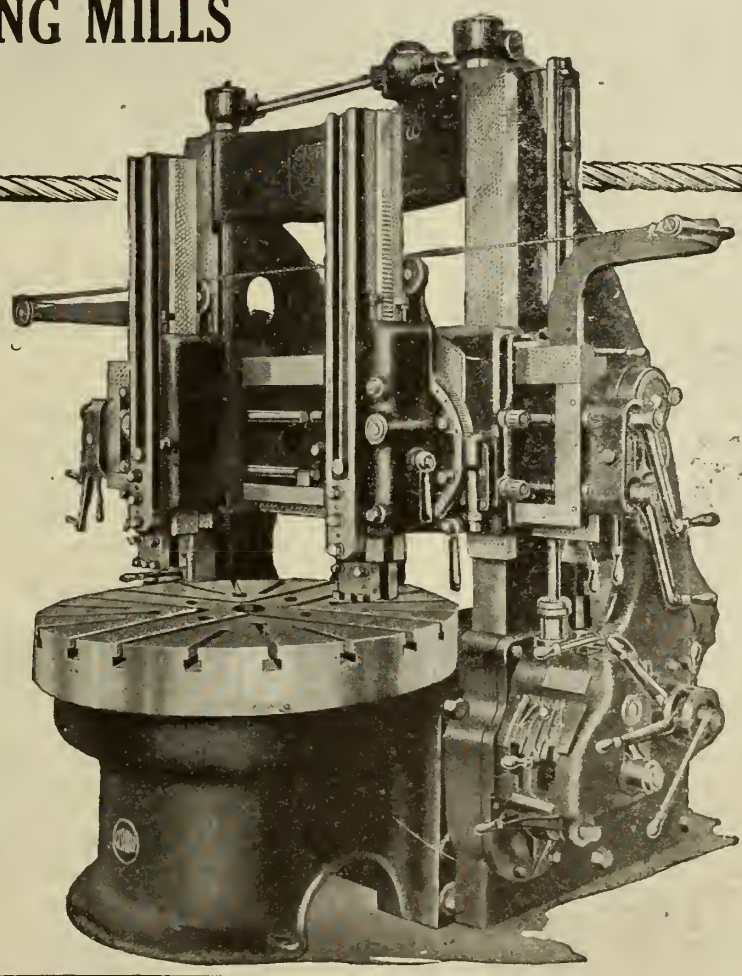
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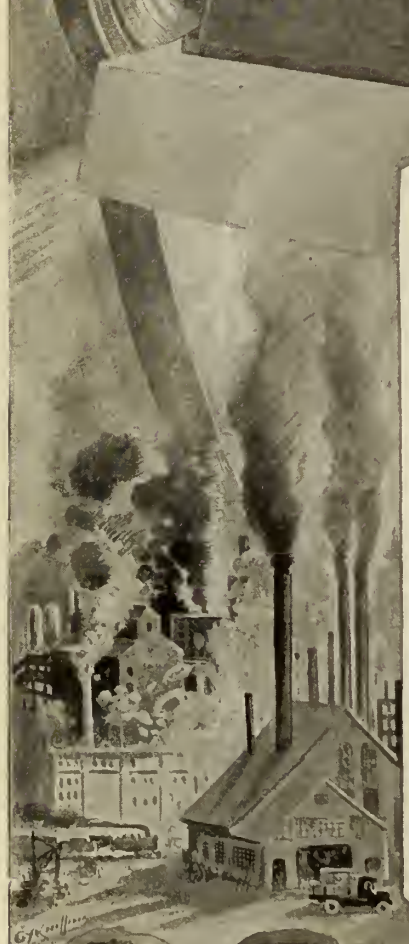
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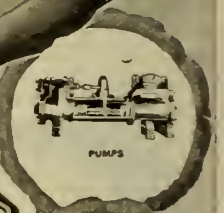
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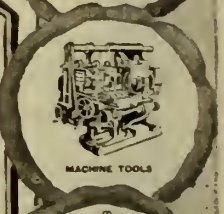
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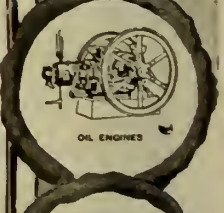
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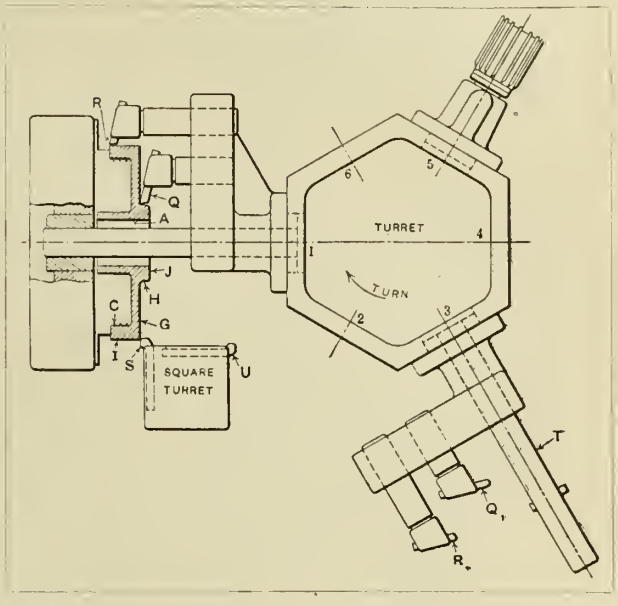
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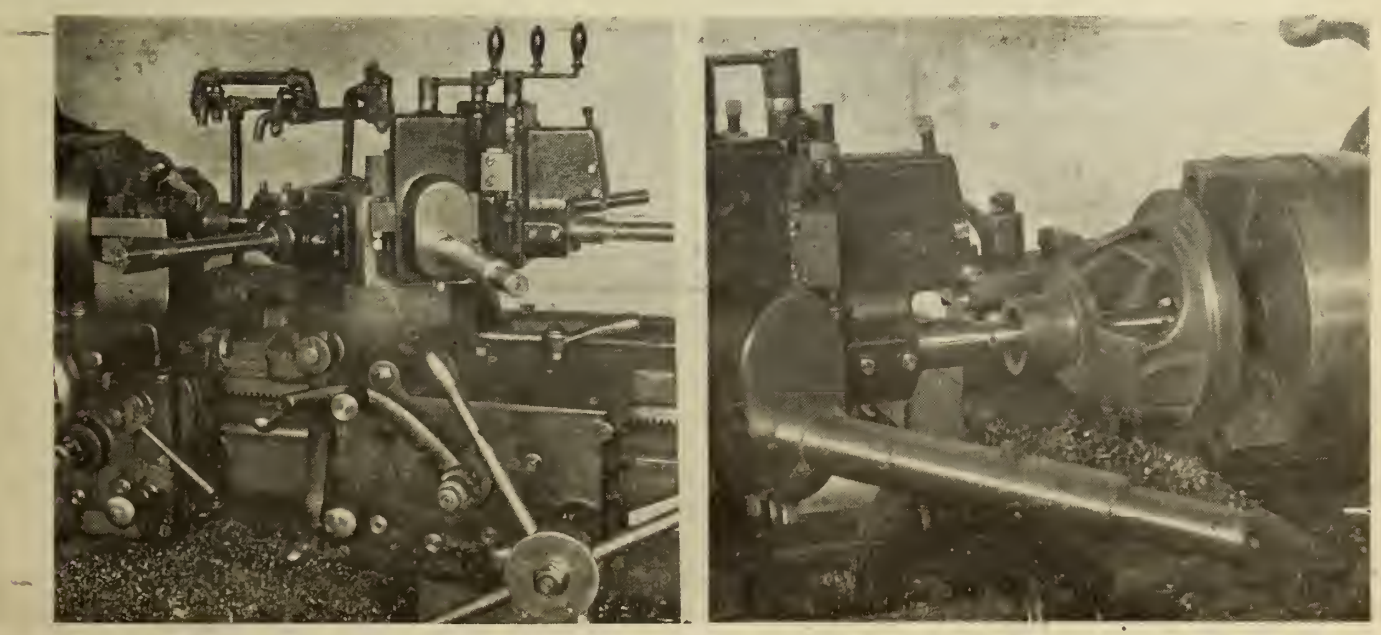
Tool layouts for a Gear Case, friction pulley, semi-steel casting, steel spindle, and other parts are shown. These layouts should be filed for future reference.



IN our previous article dealing with the practice of the Foster Machine Co., Elkhart, Ind., we showed the finishing of gear blanks, friction cores, etc., and to those who did not see it we suggest their looking it up. In the present article, which is the last one, we will go further into the question of tool layout and describe tooling equipment as used for machining automobile differential gear cases, semi-steel castings, chuck bodies, friction pulleys, and bar stock parts.

Differential Gear Case

The case shown at Fig. 1 is machined on a No. 1B universal turret lathe, the machined portion being shown by heavy lines. This portion is made of malleable iron, and is machined in 6.4 minutes. A machine equipped for this operation is illustrated at Figs. 3 and 4. A good idea of the set-up can be obtained from these views, Fig. 4 showing a close up view of both the work and tools. This photo-



FIGS. 3 AND 4—THE VIEW TO LEFT SHOWS TOOLS REQUIRED IN FINISHING DIFFERENTIAL GEAR CASE. VIEW TO RIGHT IS A CLOSE UP OF FIG. 3 FROM THE REAR.

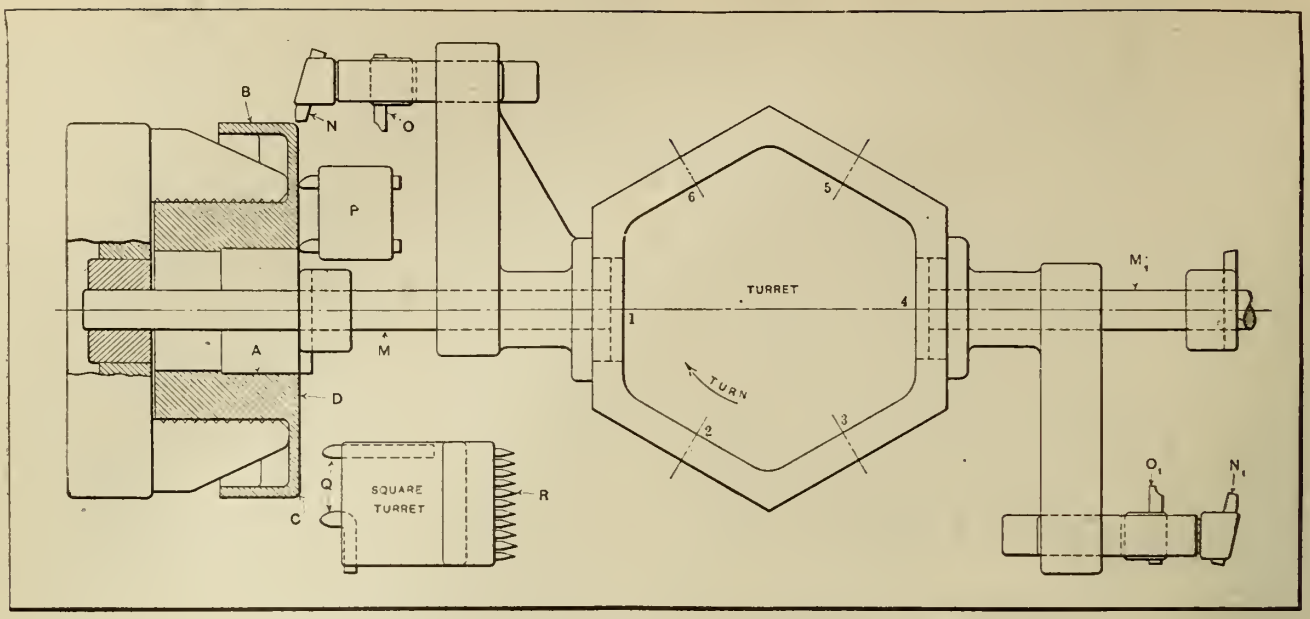


FIG. 5—SHOWING TOOLING USED IN FIRST OPERATION ON CHUCK BODY.

graph was taken from the rear of the machine.

The various steps of the operation follow in sequence. The casting is placed in a three-jaw air chuck provided with special jaws that grip the work along the periphery of the flange. The chuck is also provided with a guide bushing to suit the pilots of the various tools mounted in the turret. The holes A (see Fig. 1) are rough-bored, and surface B is turned by the tools held in double cutter piloted boring bar, this bar being mounted in a turning slide tool in the turret. The surface C is rough-turned by a tool held in the square turret, and the surface D is rough-faced by another tool in the same turret.

The hole A is next finish-bored and surface E is faced by a double cutter piloted boring bar held in a turning slide tool mounted in the turret. The surface F is rough-faced by a tool mounted in a piloted bar which is held in the turret, and the surface F is finish-faced by a tool mounted in another piloted bar, which is also held in the turret.

Holes A are now reamed by an expansion reamer mounted in the turret. The chamfer G is produced, and corner H is formed by tools mounted in a piloted bar held in a sliding tool in the turret. The casting is now removed from the machine as this completes the operations on this case.

Machining Cast Steel Chuck Bodies

The chuck body, illustrated at Fig. 2, and which is made of cast steel, is completed in two operations, the machined portions being marked in heavy lines. The time of machining is 1 hour 21.8 minutes, and the piece is completed on a No. 3B universal turret lathe. The layout of the tooling equipment as used in the first operation is shown at Fig. 5. This operation requires 42.2 minutes and the sequence of steps are as follows:

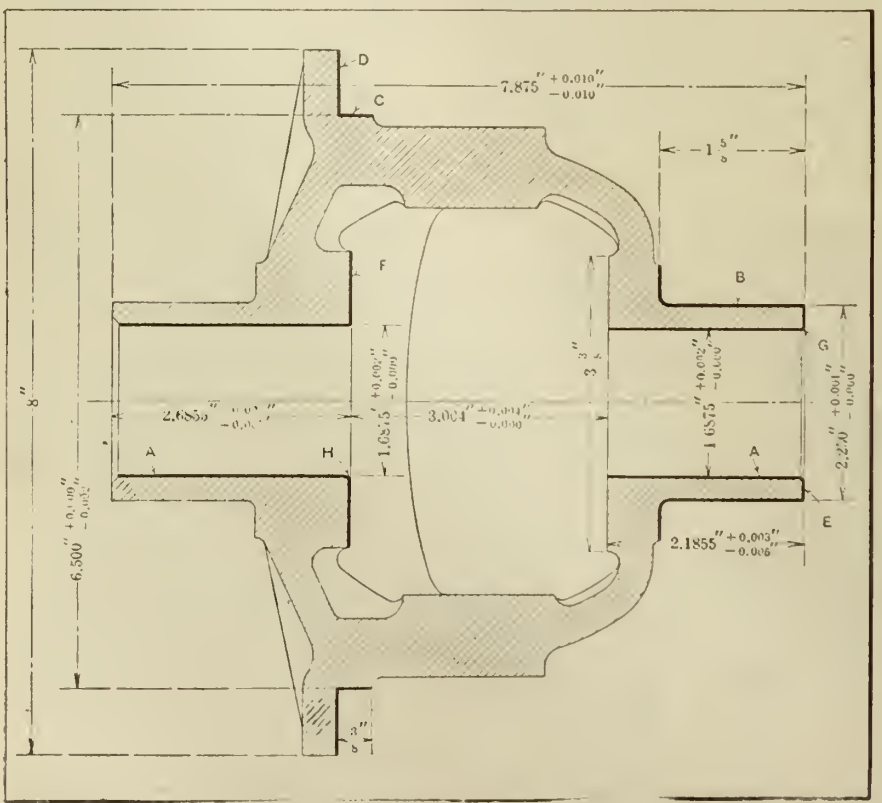


FIG. 1 DETAIL OF DIFFERENTIAL GEAR CASE.

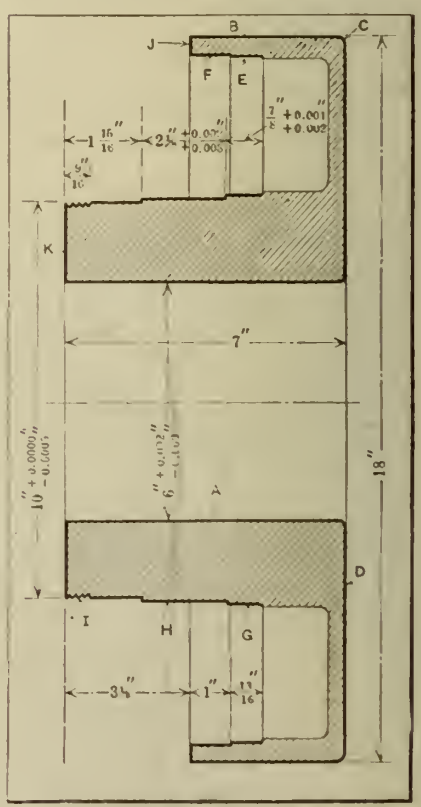


FIG. 2 VIEW OF THE CAST STEEL CHUCK BODY.

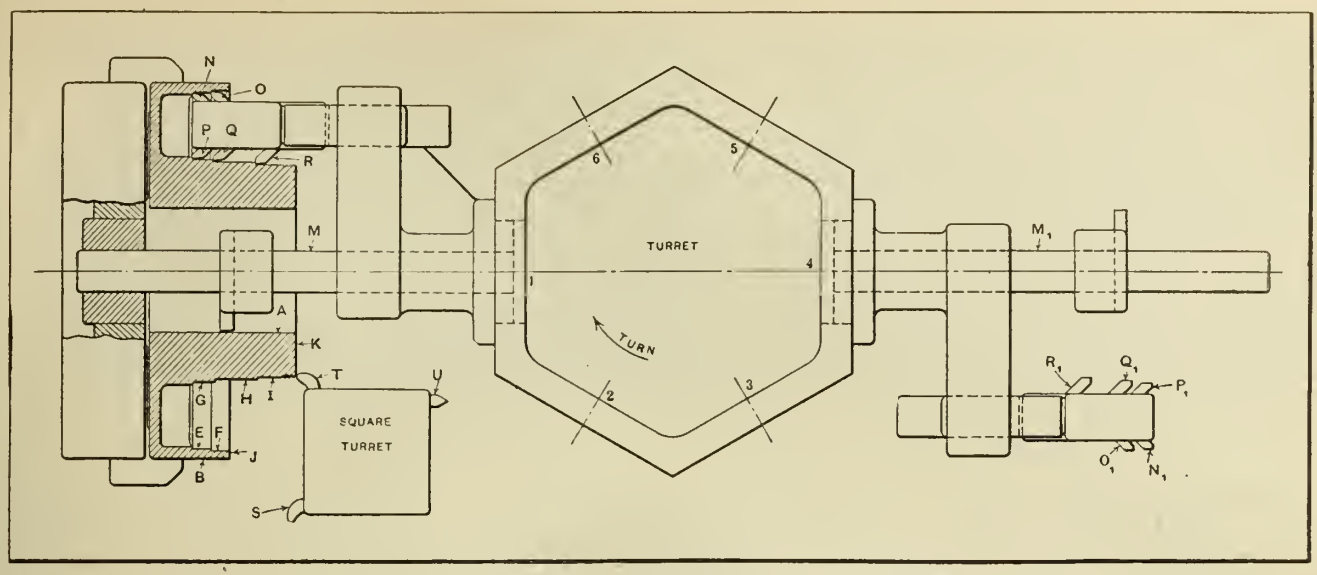


FIG. 6—THE FINAL OPERATION ON THE CHUCK BODY.

The work is mounted on a chuck equipped with three corrugated and hardened jaws that grip it on the rough surface of the hub. One half the length of hole A is rough-bored by the cutter held in piloted boring bar M. The surface B is rough-turned by tool N, and corner C is rough-turned by tool O. These tools and bars are held in the multiple turning head at position 1 of the turret.

The surface D is now rough-faced by the tools in post P on the rear of the cross-slide. The portion of hole A rough-bored in the previous step is now finish-bored by the cutter held in boring-bar M; surface B is finish-turned by tool N_1, and the corner C is finished-formed by tool O_1. These tools and bar are mounted in the multiple turning head at position 4 of the turret.

At the same time the surface D is finish-faced by tools Q, which are held in the square turret. Concentric grooves are cut on surface D by tools R, which are also mounted in the square turret. The casting is now removed from the chuck, the operation being completed.

The second operation on the chuck body is completed in 39.6 minutes. A layout of the tooling is shown at Fig. 6, and the steps are as follows. The work is mounted in a three-jaw chuck, which grips it on the previously finished surface B. The half length of hole A that is still unfinished is rough-bored by the cutter held in bar M. The surface E is rough-bored by tool N; surface F is rough-bored by tool O, surface G is rough-turned by tool P, surface H is rough-turned by tool Q, and the surface I is rough-turned by tool R. All these tools and the bar M are mounted in the multiple turning head in position 1 of the turret.

At the same time surface K and J are rough-faced by tool S, this tool being held in the square turret. The portion of hole A just previously rough-

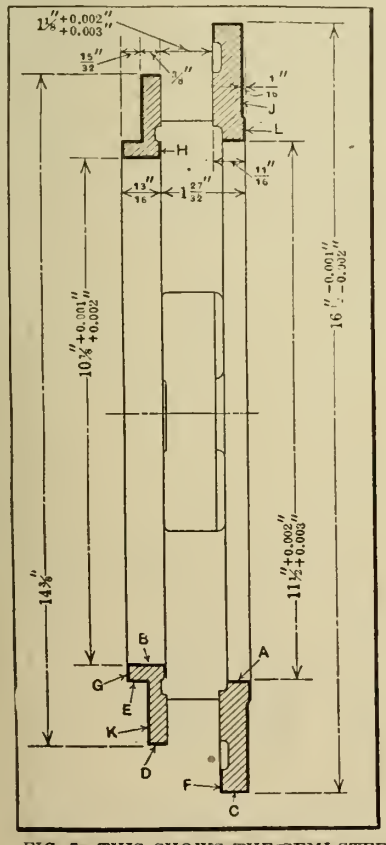


FIG. 7—THIS SHOWS THE SEMI-STEEL CASTING MENTIONED IN TEXT.

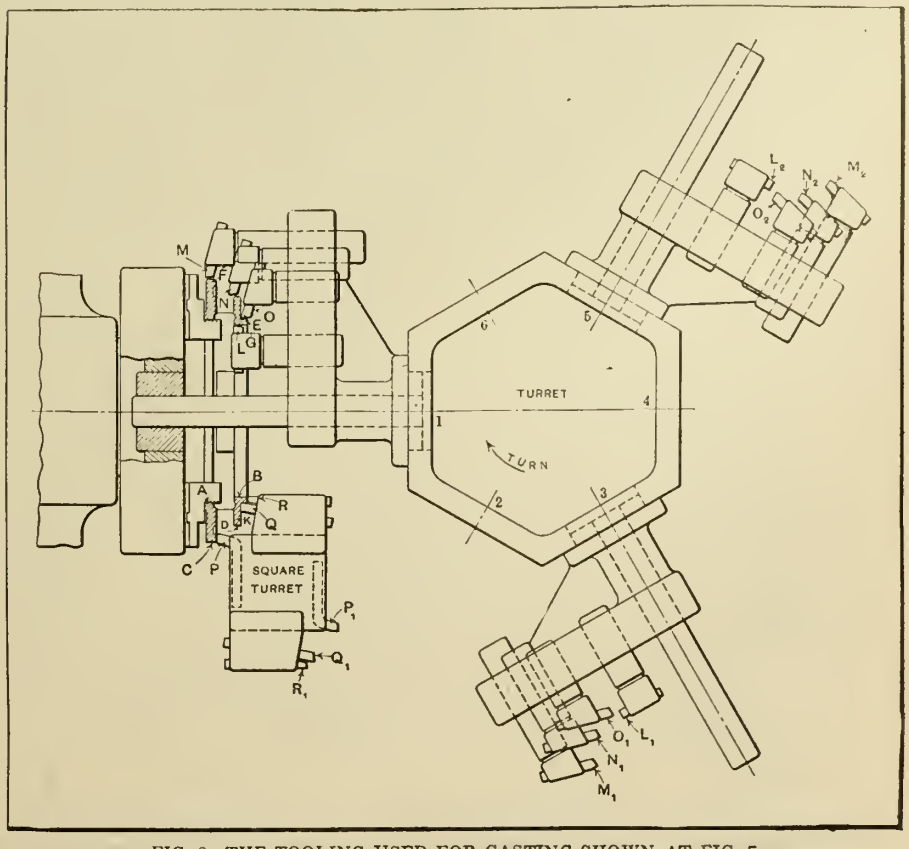


FIG. 8—THE TOOLING USED FOR CASTING SHOWN AT FIG. 7.

bored is now finish-bored by cutter held in bar M_1.

The surface E is finish-bored by tool N_1, surface F is finished-bored by tool O_1, surface G is finish-turned by tool P_1, surface H is finish turned by tool Q_1, and surface I is finish-turned by tool R_1. All the above tools and bar are held in the multiple turning head at position 4 of the turret.

At the same time, surfaces K and J are finish-faced by tool T, which is held in the square turret. The threads of surface I are now cut by tool U, mounted in square turret, and which is used in conjunction with the screw-cutting attachment. This completes the operation and the work is removed from the chuck.

Machining Semi-Steel Castings

At Fig. 7 is shown a semi-steel casting which is machined in two operations on No. 3B universal turret lathes. Both operations are completed in 16.5 minutes. The tool equipment layout is shown at Fig. 8. Following are the steps taken:

The work is placed in a three-jawed chuck equipped with corrugated and hardened false jaws which hold the work by bearing against hole A. The hole B is rough-bored by tool L_1, the surface C is rough-turned by tool M, the surface D is rough-turned by tool N, and the surface E is rough-turned by tool O. All these tools are mounted in the piloted-turning head at position 1 of the turret.

At the same time surface F is rough-faced by tool P, surface K is rough-faced by tool Q, and surface G is rough-faced by tool R. These tools are held in the square turret.

The hole B is again bored by tool L_1, and surfaces C, D, and E are again turned by tools M_1, N_1, and O_1, respectively, all of these tools being mounted in the piloted multiple turning head in position 3 of the turret. At the same time surface F is finish-faced by tool P_1, surface K is finish-faced by tool Q_1, and surface G is finish-faced by tool R_1,

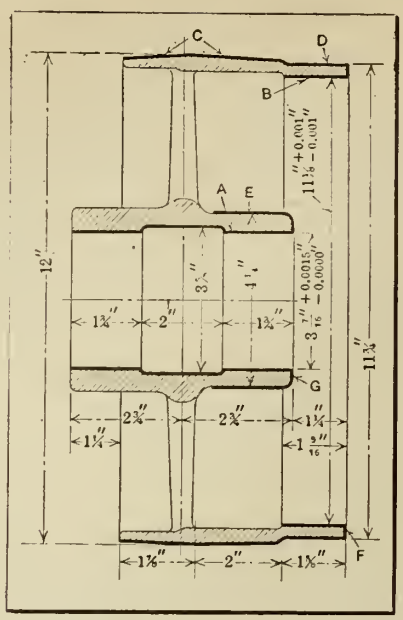


FIG. 10—SHOWING THE FRICTION PULLEY.

these being tools mounted in the square turret.

The hole B is now finish-bored by tool L_2, and surfaces C, D and E are finish-turned by tools M_2, N_2, and O_2 respectively, all of which are mounted in the turning head in position 5 of the turret. The casting is now removed from the chuck.

The remaining tool layout is shown at Fig. 9. This operation is completed in 6.6 minutes, and the sequence of steps are as follows: The work is mounted in a three-jaw chuck that grips it along the previously-finished surface C. Hole A is rough-bored by tool S, and surface H is rough-faced by tool T, these tools being mounted in the piloted multiple turning head held at position 1 of the turret. The surfaces J and I are mounted on a tool block on the rear of the cross-slide. Hole A is now finish-bored by tool S_1, and surface H is finish-faced by tool T_1, these tools being mounted on the piloted multiple turning head at position 4 of the turret. The work can be noted by the dot-and-dash line. This completes the operation and work is removed from the chuck.

Machining Friction Pulleys

The cast iron friction pulley depicted at Fig. 10 is machined in one operation on a No. 2B universal turret lathe. A machine provided with the tooling used is shown at Fig 11. This illustration shows the rear of the machine, and the photograph was taken after the pulley mounted on the lathe had been partially machined. The series of steps in this operation is taken in the following order: The pulley is placed in a three-jaw Barker chuck, equipped with special jaws that bear against the inside of the pulley rim. This chuck is also provided with a guiding bushing to suit the pilots on the various tools mounted in the turret.

Hole *A* and surface *B*, Fig. 10, are rough-bored, and surfaces *C*, *D*, and E are rough-turned by tools mounted in a multiple turning head which is held in the turret, while surfaces F and G are rough-faced by tools mounted in the square turret. Hole *A* and surface *B* are finish-bored and surface *D* is finish-bored by tools mounted in a multiple turning head held in the turret, while crown *C* is finish-turned by a tool held in the square turret and a tool mounted on a tool-holder on the rear of the cross-slide, these tools being operated in conjunction with a taper attachment on the rear of the lathe. The relief in hole *A* is bored by a cutter held in a boring-bar which is mounted in a sliding tool attached to the turret. Hole *A* and surface *B* are reamed by a special combination expansion reamer mounted in the turret. The finished pulley is now removed from the lathe.

Producing a Part From Bar Stock

Fig. 15 shows the drawing of a part machined from bar stock in one operation on a No. 1B universal turret lathe.

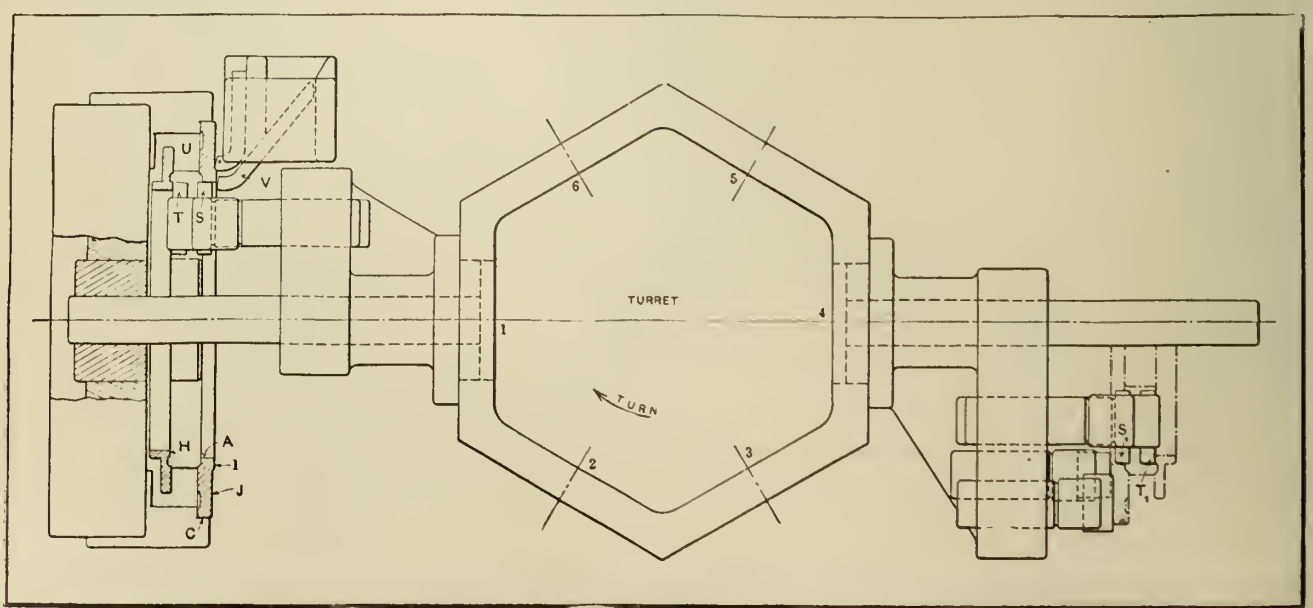


FIG. 9—THE SECOND OPERATION ON THE PIECE SHOWN AT FIG. 7.



FIG. 11—FINISHING THE FRICTION PULLEY SHOWN AT FIG. 10.

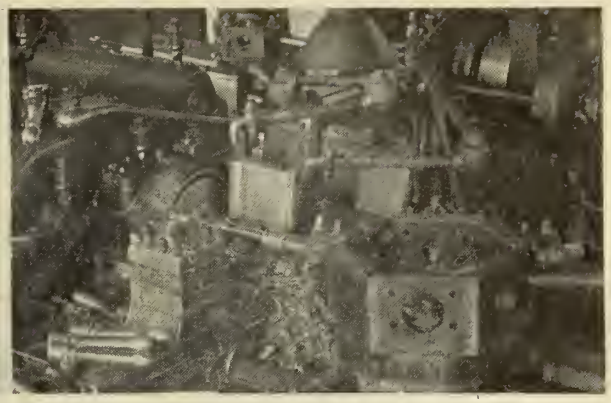


FIG. 12—PRODUCING THE PART SHOWN AT FIG. 15.

A machine engaged in producing one of these pieces is shown in Fig. 12. This illustration shows quite clearly the method employed in the manufacture of this part. The steps in this operation are taken as follows: The stock is fed to a stop on the turret and then held by means of an automatic chuck. Hole *A*, Fig. 15, is drilled by a drill mounted in a flanged tool-holder held in the turret. Hole *A* is chamfered as shown, by means of a taper reamer mounted in a flanged tool-holder held in the turret. Surface *B* is rough-turned by a tool held in the square turret. A revolving centre which is mounted in the turret is placed in hole *A* during this and the succeeding operation so as to support the work adequately during these operations.

All the remaining unfinished surfaces except surface *C* (which is not finished, the part being made from cold-rolled steel) and the surface produced when the piece is cut from the stock are finish-formed by means of a special forming tool that is held in the rear tool-holder. The completed piece is cut off from the stock by a tool held in the square turret.

Machining a Long Steel Spindle

The steel spindle illustrated in Fig. 13 is machined in two chuckings on No. 2-B universal turret lathes. It will be noted that this piece is over four feet long, while the greatest diameter is only 2¼ inches. Both operations on this spindle are performed in 35.7 minutes. A layout of the tooling equipment used in the first operation is shown in Fig. 14, this operation being performed in 19.9 minutes. There are no reference letters shown on the various surfaces of the work in Fig. 14, and so Fig. 13 must be referred to in following the method of manufacturing this part. The various steps in the operation are taken in the following order:

The stock is fed up to the stop on the turret corner between Sides 1 and 6, which permits somewhat more than one-half of the length of the piece to project beyond the chuck. Surfaces A and B are rough turned by the tool held in the single cutter turner in Side 1 of the turret, and surfaces C, D, and E are rough turned by tool T, which is held in the square turret.

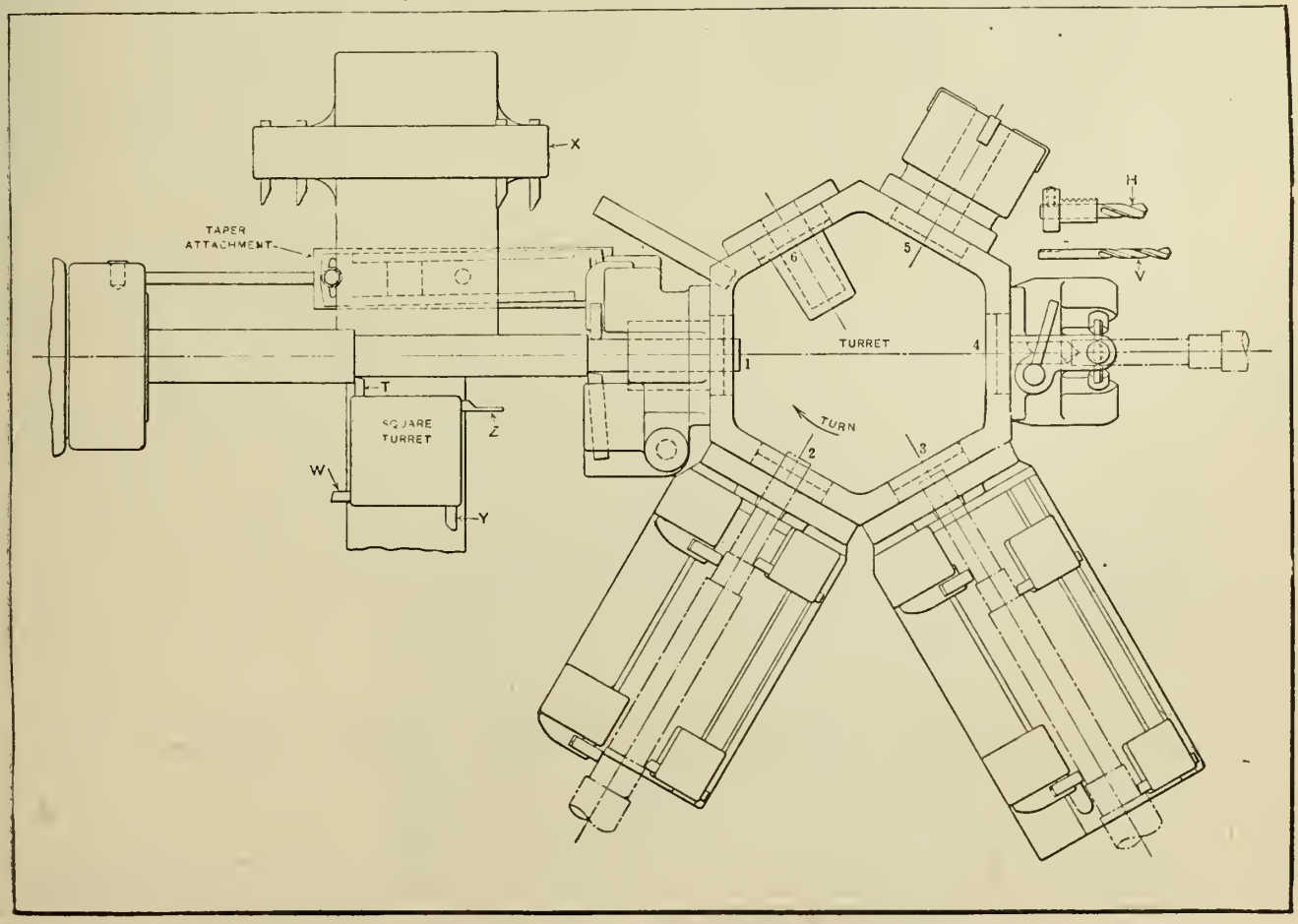


FIG. 14—TOOLING EQUIPMENT USED TO MACHINE THE SPINDLE SHOWN AT FIG. 13.

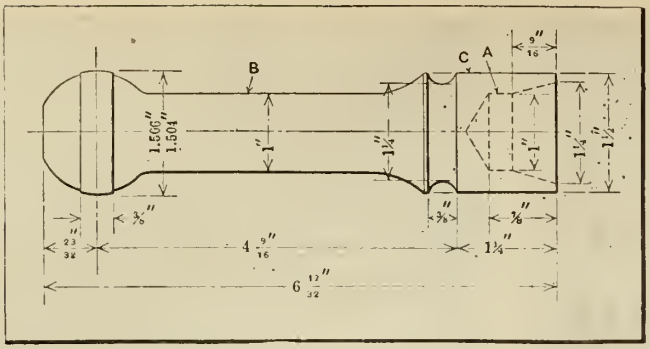


FIG. 15—PIECE FORMED FROM BAR STOCK IN ONE OPERATION.

Surfaces A and D are finish-turned and surface C is finish-straight-turned by the tools held in the multiple cutter turner in side 2 of the turret. The work is indicated in this turning fixture by dot and-dash lines. At the same time, surface F is turned by tool T. Surfaces B and E are finish-turned by the tools held in the multiple cutter turner mounted in side 3 of the turret. The work is also indicated in this fixture by dot-and-dash lines. A centre is drilled in end G by the roller-rest centering tool in side 4 of the turret. Then the centreing tool is replaced by drill H and hole H is drilled after which drill H is replaced by the tap drill V and hole I is drilled in preparation for a tapping operation which is performed in this end by hand.

The centering tool is then replaced in the fixture. While the centering holes are being drilled surface C is rough taper turned by tool W mounted in the square turret which is used in connection with the taper attachment. While end G of the shaft is still supported by the centering tool in position 4 of the turret, the necking tools mounted in fixture X on the rear of cross-slide are first located, then the four grooves between the various surfaces on the right hand end of spindle are turned by these tools.

The threads on surface E are now cut by the self-opening die head mounted in position 5 of the turret. The stock is fed up to the special stop in position 6 of the turret, which permits slightly more than the total length of the spindle to project beyond the chuck.

While the stock is supported in the stop just mentioned, the shaft is chamfered at end O by tool Y, which is held in the square turret, so that the single cutter turner which turns surface I in the succeeding operation can be properly started.

While the piece is still supported in the stop in position 6 of the turret, the spindle is cut off from the stock by tool Z, which is also held in the square turret. The projecting end of the stock is chamfered at the same time by tool Z so that the single cutter turner used to turn this end of the succeeding spindle can be correctly started.

The second operation on the spindle consists of machining the left hand end, and is performed in 15.8 minutes. The work is held in a chuck equipped with a collet bushing that grips the work around the previously finished surface F. The tooling equipment used in this operation is identical with that shown at Fig. 14, because surfaces J, K, L, M, and N, and holes P and Q, are of the same dimensions as surfaces A, B, C, D, and E, and holes H and I, which were machined by means of this tooling equipment. The only difference between the two operations is the machining of surface F, which is performed in the first operation. For this reason a detailed description of the steps in the second operation is not necessary. This concludes the present article and readers will do well to preserve these various layouts for future reference.

IDENTIFYING THEIR PRODUCT

The Skinner Chuck Company, Inc., of New Britain, Conn., have recently joined the ranks of American manufacturers who identify their products with a trade mark. The new trade mark of this company, while very simple, is really unique. It shows an alligator in the form of the letter "S," superimposed on a solid black circular background, with the words "Skinner Chucks" drawn around the outside. The alligator was chosen after long deliberation as the symbolic figure best suited to the exploitation of their idea, because both the alligator and their chucks have strong jaws and long life.

The trade mark will be stamped on all their chucks in the future to indicate that the same was made and is guaranteed by the company. A special advertising campaign extending over two months in prominent metal-working publications and other publications of interest to chuck users is the vehicle by which the company will make the trade mark known to the present and potential buyers of their products.

A NEW RADIO STATION

A new wireless station at Siasconset, Nantucket Island, Mass., has been opened by the International Radio Telegraph Company. The site is a historic one, from a wireless standpoint, for temporary stations have been located here ever since the beginnings of wireless, but permanent, commercial service is now established at this point.

This new station, which is the fifth to be opened by the company, is now the nearest one on the Atlantic coast for vessels coming from Europe. Its working radius is more than 250 miles by day and 1,000 miles by night. It has direct cable connections with Wood's Hole, and is thus in touch with the entire country.

Current for operating this plant is obtained from a storage battery which is charged when necessary by means of a generator driven by a gasoline engine. The transmitter is of the spark-gap type of 2 kw. capacity, and is equipped for operating on either a quenched spark gap or a rotary synchronous spark gap. The frequency of the radio motor generator set is 500 cycles, with a sparking rate of 1,000 per second. The current in the antennae circuit for 2 kw. input is 15 amperes. The receiver is adapted for either damped or undamped waves over a range of wave lengths of from 300 to 3,000 meters.

The radio call for this station is WSC. Land line charges will be computed from Wood's Hole.

DUMPING BODY FOR TRUCK

The Karry-Lode Truck Company, of Long Island, City of New York, are now manufacturing an all-steel dumping body for their electric trucks. These have a capacity of 40 cubic feet, dump over the end of the truck, and are especially adapted for coal handling.

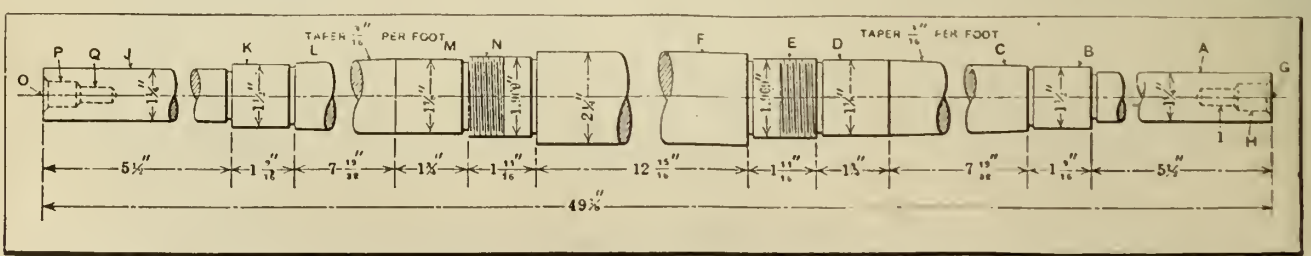


FIG. 13—A LONG STEEL SPINDLE PRODUCED FROM BAR STOCK IN TWO CHUCKINGS.

Portable Boats of Early Railroad Practice

Did You Know That the Transportation of freight and passengers Between Philadelphia and Pittsburgh Was Successfully Conducted in CANAL BOATS? —It Was—But Many Years Ago.

By J. SNOWDEN BELL

IT WILL be a matter of surprise, not merely to the general reader, but as well to most persons familiar with the operation of railroads, to know that many years ago the transportation of freight and passengers between the cities of Philadelphia and Pittsburgh was largely and successfully conducted in canal boats, which traversed the entire distance between these terminals, partly by railroad and partly by canal. There are but few persons now living who, like the writer, have seen these boats in service, and the data as to their origin and development, and their railroad transportation equipment, are so meagre and so scattered that a record of it, while merely a matter of history, may be found also to be of sufficient interest to warrant its presentation.

What was known as the main line of the Public Works of the State of Pennsylvania, extending from Philadelphia to Pittsburgh, and aggregating 394.6 miles, was constructed by the state and completed in March, 1834. It was for a number of years—that is, until June, 1857, when it was sold to the Pennsylvania Railroad Company—operated by the state, under the control of a board known as the Canal Commissioners. It comprised a line of double track railroad from Philadelphia to Columbia, 81.6 miles; a canal from Columbia to Holidaysburg, 172 miles; the Allegheny Portage Railroad, crossing the Allegheny Mountains and extending from Hollidaysburg to Johnstown, 36.6 miles, and a canal from Johnstown to Pittsburgh, 104 miles. Horses were the first motive power on both these lines of railroad, but were soon superseded by locomotives, and mules were always used for haulage on the canals. At noted in Wood's "Practical Treatise on Railroads," 2nd edition, 1832: "This railroad is therefore the first which was undertaken in any part of the world by a government."

The boats used in this system of combined land and water transportation, which were generally termed "portable" boats, will be first considered, and be followed by general notes of the equipment by which, in their earlier service, they were carried over the railroad sections of the route.

The Portable Boats

The transfer of boats from one level of a canal to another, upon carriages running on inclined planes, instead of floating them through locks, of course involved, broadly speaking, their movement both on land and in water. This was a well known practice long prior to the operation of the Pennsylvania public works system, and is even said to have been practiced by the ancients, who did not appear to have known of canal locks. An illustration appears in Stevenson's "Sketch of Civil Engineering in North America," 1838, of a boat and "boat car" used on the Morris Canal of New Jersey, which the author states was "the only canal in America in which the boats are moved from different levels by means of inclined planes instead of locks." This prior practice, however, has obviously no bearing derogatory to the merit and novelty of the Pennsylvania portable boats.

The initial step in the transportation of boats over the railroad tracks of the Pennsylvania public works—which, however, was not on a commercial scale—or by the use of sectional boats, is recorded in Day's "Historical Collections of the State of Pennsylvania," Philadelphia, 1843, as quoted from a prior publication, which is not named, as follows:

"In October, 1834, this portage (the Allegheny Portage Railroad), was actually the means of connecting the waters of Eastern Pennsylvania with those of Mississippi; and as the circumstance is peculiarly interesting we here place it on record. Jesse Chrisman, from the Lackawanna, a tributary of the north branch of the Susquehanna, loaded his boat, named "Hit or Miss," with his wife, children, beds and family accommodations, with pigeons and other livestock, and started for Illinois. At Hollidaysburg, where he expected to sell his boat, it was suggested by John Dougherty, of the Reliance Transportation Line, that the whole concern could be safely hoisted over the mountain and set afloat again in the canal. Mr. Dougherty prepared a railroad car calculated to bear

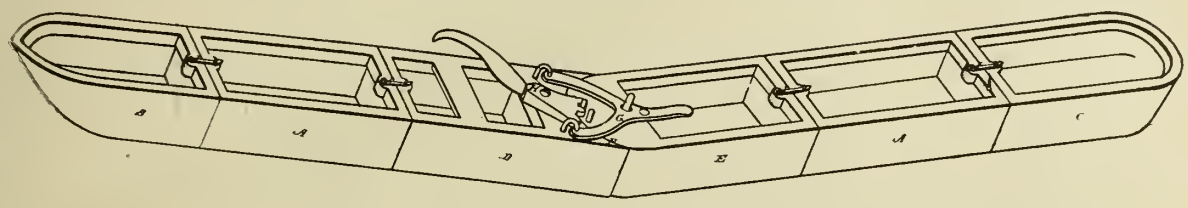
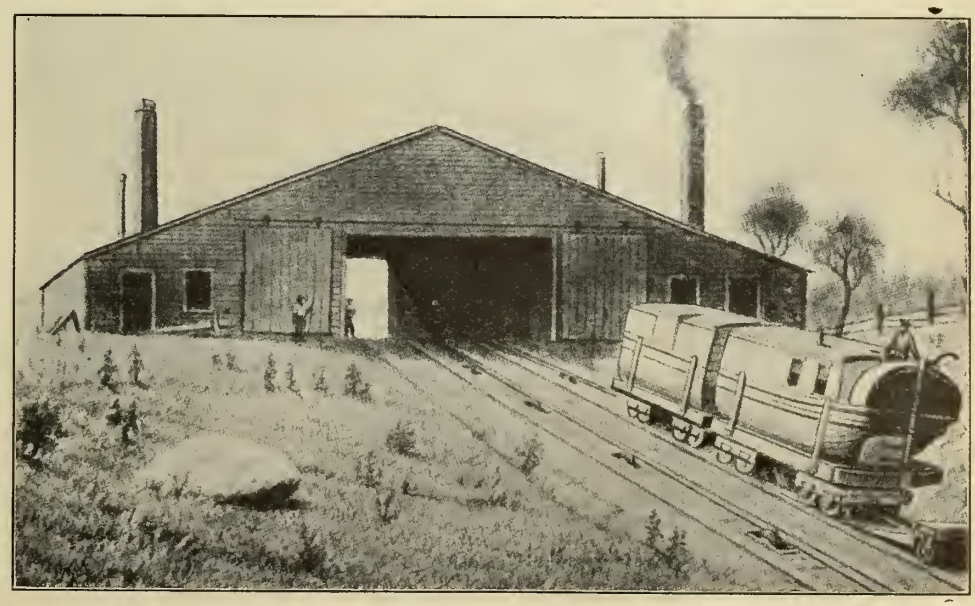


FIG. 1—A REDUUCED REPRODUCTION OF THE ELGAR PATENT CANAL BOAT.



A SECTIONAL BOAT ASCENDING ONE OF THE INCLINED PLANES ON THE ALLEGHENY PORTAGE RAILROAD.

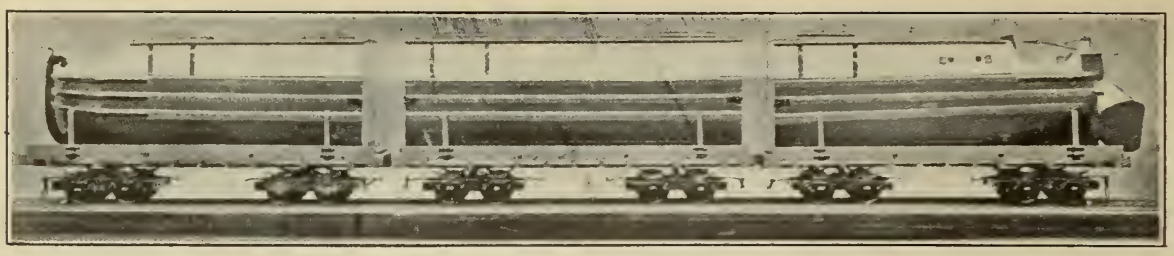


FIG. 2—THE SECTIONAL BOAT PATHFINDER REFERRED REFERRED TO IN TEXT.

the novel burden. The boat was taken from its proper element and placed on wheels, and under the superintendence of Major C. Williams (who, be it remembered, was the first man who ran a boat over the Allegheny Mountains) the boat and cargo at noon on the same day began their progress over the rugged Allegheny. All this was done without disturbing the family arrangements of cooking, sleeping, etc. They rested at night on the top of the mountain, like Noah's Ark on Ararat, and descended next morning into the valley of the Mississippi, and sailed for St. Louis." The author of the "Historical Collections," referring to the conditions of operation when he wrote, adds:

"The trip of a boat over the mountain is now no novel sight, except that instead of going over whole, they are so constructed as to be separated into three or four parts on reaching the railroad. After thus mounting the cars piecemeal, with their loads of emigrants, baggage and freight on board, they wend their way over the mountains, and resuming their proper element at Johnstown, they unite their parts again and glide on to the waters of the great West."

The earliest record of the idea of constructing a canal boat in separate sections for transportation over a portage between two lines of canal, appears in a report on a survey of the Juniata route, made by Canvass White, a civil engineer, to the Canal Commissioners of Pennsylvania, which is printed on page 83 et seq. of the commissioner's report, dated February 7th, 1827. In this report, Mr. White says:

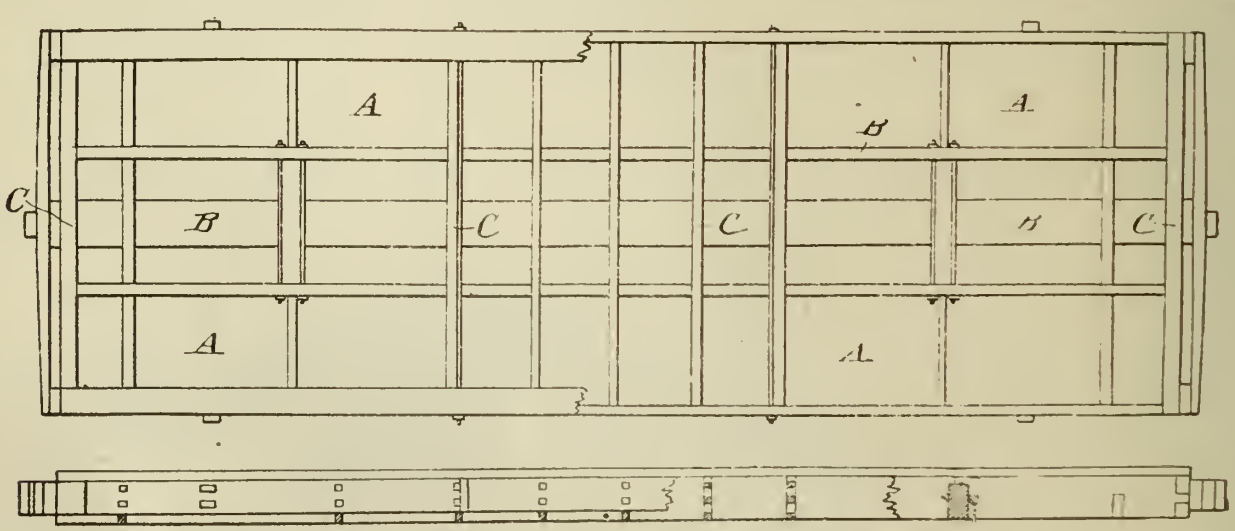
"I made a partial examination of the country over which the railway must pass, and from the general appearance I think the ground is favorably situated, considering the formidable barrier interposed between the eastern and western wtaers. A good turnpike road would probably answer all the purposes of transportation for several years, and a part of the bed could be occupied by the railway whenever the business should require its construction. I would suggest the idea of making the canal boats in three or four pieces, to be divided transversely, and transported over the portage without changing the cargo."

The credit of the invention of means for operating on a commercial scale, transportation of freight and passengers, without unloading and reloading or transferring, over a route comprising both canals and railroads, is due to John Elgar, a civil engineer of Baltimore, Md. After having devised and patented other appliances relating to railroads, a patent of the United States was granted to him on November 7th, 1835, for what he designated as "certain improvements in the art of, and in the apparatus for the conveyance or transportation of goods, on a line where canals and railroads form alternate links in the chain of communication, as for example, on the great Pennsylvania line from Philadelphia to Pittsburgh."

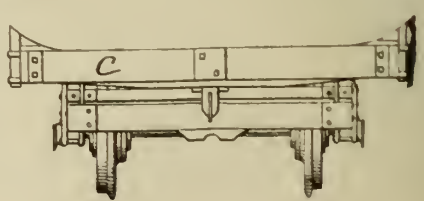
While this patent is later by about thirteen months than the date when the small boat "Hit or Miss" was carried over the Allegheny Portage Railroad, as before noted, and while that railroad transfer from one canal to another may, perhaps, have suggested Elgar's invention, that invention is none the less meritorious, by reason of its inauguration of a commercially valuable practice on an extended scale.

Fig. 1, which is a reduced reproduction of the drawing of the Elgar patent, is apparently the earliest representation of a sectional canal boat anywhere recorded, and the principle of the Elgar invention, upon which the subsequent practice on the main line of the Pennsylvania public works was based, is fully and clearly stated in the specification of the patent, as follows:

"The object which I have in view, in the first instance, is to prevent the necessity of removing the goods from the vehicle within which they are first loaded by constructing cases which serve on railroads as car bodies, and on canals as boats. This I effect by making such vehicles, or car bodies, of sheet iron, in the manner of iron tanks, riveting them up watertight in the same way. The dimensions of these bodies must be determined by that of the canal locks



FIGS. 3, 4 AND 5—A PLAN VIEW OF TRUCK, A SIDE VIEW AND AN END VIEW.



through which they are to pass when used as boats. If, for example, the lock will admit a boat of fourteen feet in width, and eighty in length, the bodies may be made seven feet wide and twenty feet long so that eight bodies, two abreast, and four in length, may pass at the same time. I intend sometimes to make the bodies wholly of sheet iron, but they may be made of that material to a height of about three feet only, with an additional height, say of three feet, made of wood. The bodies, when made of this length, are to be carried upon eight-wheeled cars. If four-wheeled cars are preferred the bodies must be made of a length suitable thereto, and a greater number of them will then, of course, be connected together when in the water.

"As these bodies are, by their combination, to form canal boats, the requisite number of them are to be so formed at one end as to constitute a well-shaped bow, and the same number are to be so shaped as to constitute a stern; the other ends are to be made square so that when connected by proper fastenings they will be in one continuous inflexible line, to the length of the lock through which they are to pass."

On February 24, 1843, patent No. 2973 was granted to John Dougherty, of Hollidaysburg, Pa., who was doubtless the constructor of the car on which the "Hit or Miss" was carried over the Allegheny Portage Railroad, in October, 1834, as before noted. The specification states the invention to be "certain improvements in the apparatus for the transportation of goods on canals and railroads; said improvements consisting in a more perfectly carrying out of the method of transportation for which Letters Patent of the United States were granted to John Elgar, dated on the 7th day of November, 1835, and of which I am the assignee for the State of Pennsylvania."

Fig. 8 of the Dougherty patent is stated in the specification to be a side view of a four-section boat, and Fig. 9, a top view of a double series of sections, bolted or keyed together, but the sheet containing these views cannot be found in the Patent Office, having unfortunately been lost or accidently destroyed. The general features of the design may, however, be understood from the following exerpt from the specification:

"The boats, or boxes, may be made of sheet metal, or of wood; or their lower portions may be of metal, and their upper of wood; the invention not being in any way dependent upon the kind of material employed. I connect these boats, or boxes, together, when they are used on canals, in such manner as that there shall be two sections in width, and three, or more in length. In this respect my plan of connecting the sections is not the same with that adopted by Mr. John Elgar, who proposed to connect them in a continuous line, and in such manner as that they should possess a certain degree of flexibilty at the places where they were joined to each other; but when so joined, they have not been found to operate well, as they cannot be kept with their sides and bottoms coincident, but vary laterally, as well as upward and downward, from which cause they are liable to be injured by snags or rocks, and have their motion retarded by the water. A still more frequent difficulty resulting from the original mode of connecting them has arisen from the want of a free passage of the towing lines from end to end of the boat, all of which objections I obviate by attaching to the fore end of each section, which is to have a rear section joined to it, a plate of iron, six or eight inches more or less in width, and of such length as that it shall extend entirely across the under part of the section, from side to side, and sufficiently high on each side to confine the two parts, or sections, in place.

Such plates are to be bent so as to conform to the curvature of the bottom, are to be fastened to one of the segments by bolts, or otherwise, and to project over and form a ledge, say two-thirds more or less of their width, so that the rear section may be received and rest upon it. The sections are then to be firmly secured end to end by loops and keys, or in some analogous mode, until the intended length is obtained, and two such series of sections are to be secured by bolts, bars, or clasps, side by side, and are thus to constitute a combined boat, of the ordinary width of a canal boat, and in length adapted to the locks through which they are to pass."

An extended search has failed to develop any drawing illustrating the structural details of the sectional boats as actually built and operated, and the recollection of the few now living who have seen them is so much impaird by the long lapse of years as not to be fully reliable. Their characteristic features may, however, be sufficiently understood by reference to Fig. 2, which represents

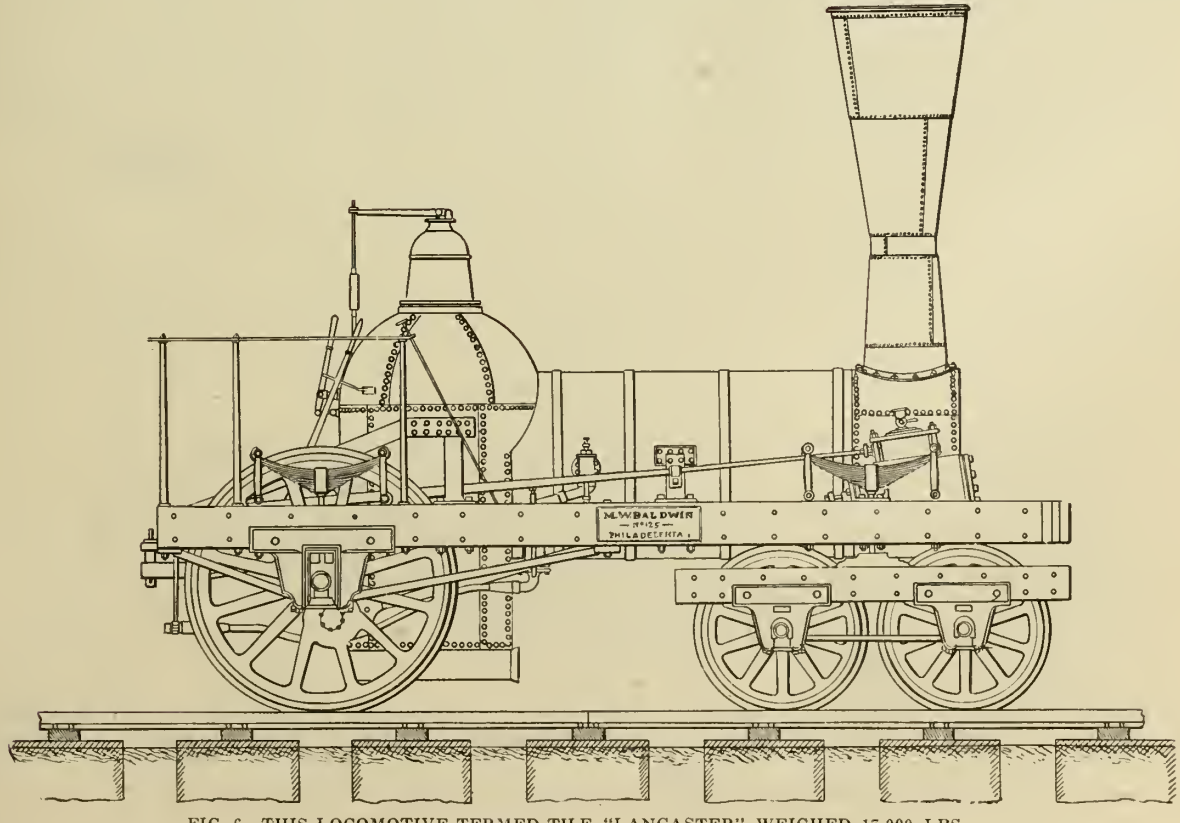


FIG. 6—THIS LOCOMOTIVE TERMED THE "LANCASTER" WEIGHED 17,000 LBS.

the sectional boat "Pathfinder," a model of which formed part of the exhibit of the Pennsylvania Railroad Co., at the Chicago Exposition, in connection with the following description, which is given by Capt. H. A. Walters, of Lewistown, Pa., who, in 1849, started as a driver on the Pennsylvania Canal.

"These (the sectional boats) were 82 feet in length, 13 feet in width, and in depth 12 feet, and were divided into four sections, each 20½ feet long; the boats were round on the bottom and not flat. The sections were fastened together by irons about half way down the side—the iron projected out from the one section into a V-shaped iron on the other section, then a T-iron fitted down through both of these irons and locked them together. One section was placed upon one railroad truck which was a little bit longer than the section—say about 23 to 24 feet, and had four wheels. . . . The trucks were round in the bottom to fit the boat's sections."

Capt. Walters' statement of the width of the boats is manifestly erroneous, as they could not, for the reason hereafter stated, have been in excess of about 7 feet 9 inches in width. This is also indicated in the first illustration, which is reproduced from an illustration in the Philadelphia Commercial Museum, and represents the stern section, and an intermediate section of a boat, loaded on the so-called "trucks," ascending an inclined plane on the Allegheny Portage Railroad, to be delivered to a locomotive at the summit.

The Railroad Hauling Equipment
The Transporting "Trucks"

In transporting the sectional boats over the railroad divisions of the main line of the Public Works of Pennsylvania, each section was loaded upon an eight-wheeled car, known as a "truck," although it was fitted with two four-wheeled trucks, one at each end, and the trucks were coupled up in a train which was hauled over the railroad divisions by a locomotive. On arriving at the canal terminal of a division, the trucks were lowered into the canal, and the sections of the boats were coupled together and hauled through the canal to the next railroad division by horses. The writer has, when a boy, seen sections of these boats, on their trucks, being loaded in a forwarding house or private freight station at Eighth and Market Streets, Philadelphia, from which they were hauled by horses to the Willow Street Railroad, over which the trucks were hauled a few miles by a locomotive to the inclined plane at Belmont, on the Schuylkill River, and thence by a locomotive to the canal at Columbia, Pa.

The only illustration of these flat cars or so-called "trucks," which has been developed, or which it is probable is now in existence, is that which appears in the drawing of the Dougherty Patent before referred to, three of the views of which are here reproduced, as Fig. 3, a plan view of the car body; Fig. 4, a side view, and Fig. 5, an end view. The four-wheeled trucks, not involving any departure from the ordinary practice at their date, are not here shown.

The description of the car, given in the specification of the patent, is as follows:

"In constructing the cradle it is necessary to limit its width to about 8 feet 9 inches; the passing along the road forbidding that this width should be exceeded; it is necessary, also, that the cars should be capable of running upon curves of fifty or sixty feet radius. The truck wheels which I use are about 2 feet 9 inches in diameter, and instead of being kept to the level of the upper sides of the side pieces of the truck frame, as formerly, they are allowed to rise about a foot above them."

The drawing of the patent does not show side stakes, or any other means for holding the boat section in position on the cradle, and if the stakes were used as would appear to be the case, the width of the boat section would probably not be greater than about 7 feet 9 inches in view of the limitation of clearance before mentioned.

The specification further says that: "The longitudinal timber, B, B, may in this case be a foot in depth, and the width of the space, A, A, must be such as, but need not be greater than will admit of the trucks adapting themselves to the curves of 50 or 60 feet radius, as above named. The trucks work on centre bolts, a, a, as usual. The cross timbers, C, C, of the cradle, are on their upper sides, adapted to the form of the bottom of the boat."

The Early Locomotive Power

The Canal Commissioners, under whose control, as before stated, the connected system of railroads and canals over which the sectional boats were run was operated, were authorized by an Act of the Pennsylvania Legislature, approved April 15, 1834, to use locomotive engines as motive power, which theretofore had been horses. In pursuance of this authorization they ordered a number of locomotives from the works of M. W. Baldwin, of Philadelphia, the first of which, the "Lancaster," was put in service on the Philadelphia & Columbia R. R., June 28, 1834, and the second, the "Columbia," September 10, 1834.

The "Lancaster," which is shown in Fig. 6, weighed 17,000 pounds, and had cylinders 9 by 16, and driving wheels 54 inches in diameter. The "Columbia" was of the same weight and dimensions. It is shown by the records that the

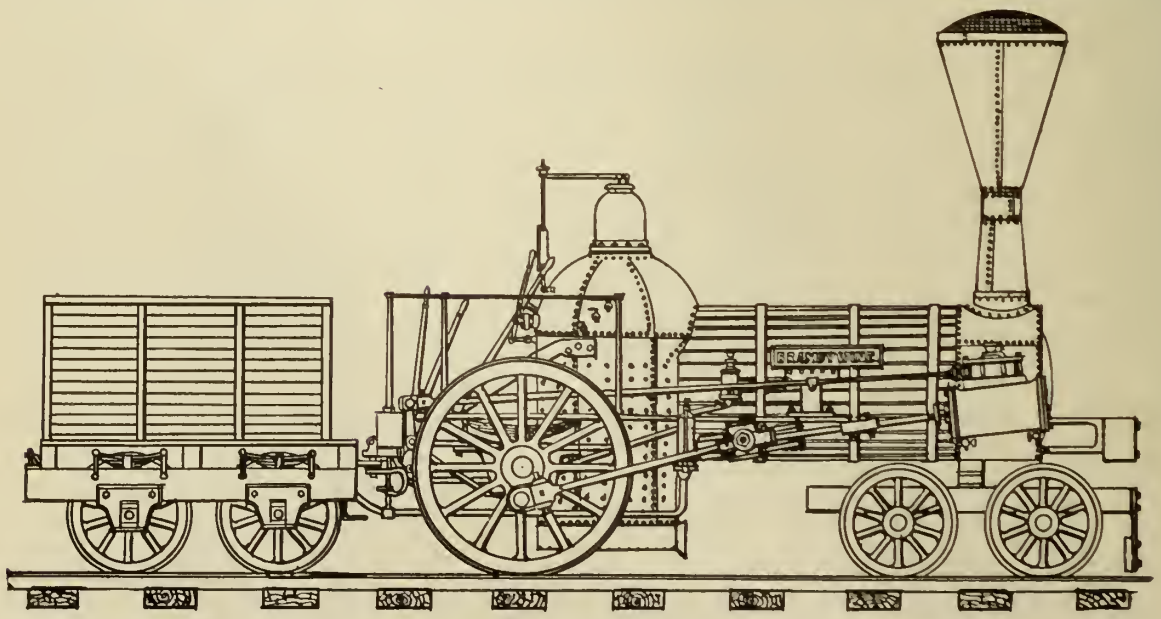


FIG. 7—THE BRANDYWINE. THIS STYLE HAS OUTSIDE CONNECTIONS INSTEAD OF THE HALF CRANK DRIVING AXLE

"Lancaster" hauled a train of nineteen burden cars over the heaviest grades between Philadelphia and Columbia, which was characterized at that time by the officers of the road as an "unprecedented performance." The weight of these locomotives was in excess of that which was estimated by the Canal Commissioners to be within the capacity of the rails of the Philadelphia & Columbia Railroad, as, in their report of December 7, 1833, they say: "The Wiggan (English) rail, weighing forty-one and a fourth pounds per yard, has been adopted for both tracks of the sixty miles now in progress. It is calculated for carrying locomotive engines weighing six tons." The weight of the Baldwin locomotives was not, however, found to be objectionable, and the reports of their performance were, in all particulars, satisfactory.

In his report to the board of Canal Commissioners of November 7, 1834, Mr. Edward F. Gay, principal engineer, referring to the engines "Lancaster" and "Columbia," says:

"Indeed, these engines are justly considered superior and beautiful specimens of mechanism, and reflect great credit on the ingenious mechanic (M. W. Baldwin, Esq., of Philadelphia), who constructed them. They are each supported on six wheels, which is found to be the only arrangement that will enable a locomotive engine to overcome the severe curves connected with the high grades upon this road without injury to the engine or railway."

In the same report these engines are further referred to as follows:

"As all the engines preparing for the road are designed to be of the same class, the following statement of the capacity of the 'Lancaster' may be applied to the others. Weight of engine, 8 tons; capable of drawing 36 tons, exclusive of cars—say 56 tons gross. Amount taken at each load limited to 30 tons, or about 48 tons gross. Running time between the inclined planes (77 miles) with the above load, 8 hours, including stoppages.

Expenses of the Trip

20 bushels coke at 20c	$4.00
1½ cords wood at $4	6.00
Engineer and attendants	4.00
Oil	.60
Total	$14.60"

Eight more locomotives, all of the same general design as the "Lancaster" and "Columbia," were built by Mr. Baldwin for the State up to the close of the year 1835, these being the "Philadelphia," November 26, 1834; "Pennsylvania," January 3, 1835; "Delaware," February 7, 1835; "Susquehanna," March 12, 1835; "Schuylkill," April 1, 1835; "Kentucky," July 14, 1835; "Juniatta," September 5, 1835; and "Brandywine," October 21, 1835.

As shown in Fig. 7, the "Brandywine" differed from the first engines in having outside connections instead of the "half crank" driving axle, and an iron frame instead of a wooden one. The report of Mr. Gay, the principal engineer, rendered November 7, 1834, includes an estimate for "Eighteen locomotive engines and tenders complete, at $6,300 each, $113,400," and in his report of October 30, 1835, which covers all the ten before noted Baldwin locomotives, he says:

"The engines upon this road have generally performed their trips with great regularity; and it affords me pleasure to add that the American engines, delivered within the present year, are capable of doing more work than was estimated in my last report; the most of them, in their ordinary trips, draw a gross load of 75 tons. The engine 'Schuylkill' has drawn over the road a gross load of 100 tons, and several others have drawn, over the highest grade, from 80 to 90 tons gross. When the curves and grades upon the road are taken into consideration, it is believed that the performance of these engines will be found equal to any in America."

The second locomotive that was built by Mr. Baldwin, the "E. L. Miller," which was the immediate predecessor of the "Lancaster," was equipped with a form of traction increaser by which a portion of the weight of the tender could be transferred to the driving wheels of the locomotive, thereby increasing their tractive power. This device was brought out by E. L. Miller, president of the South Carolina Railroad, for which road the engine bearing his name was constructed, and a patent for it was granted to him, June 19, 1834. As the Miller device was applied on locomotives built for the Canal Commissioners, a description of it may be found of interest in this connection.

Fig. 8 is reproduced from the drawing of the Miller patent, the specification of which specifies the invention as consisting in "using the tender, or car, next to the engine, for the purpose of adding weight to the driving wheels of the engine at such times only as a greater adhesion is required than the weight would give, which it would be practicable to carry as a fixed weight on those wheels without injury to the road."

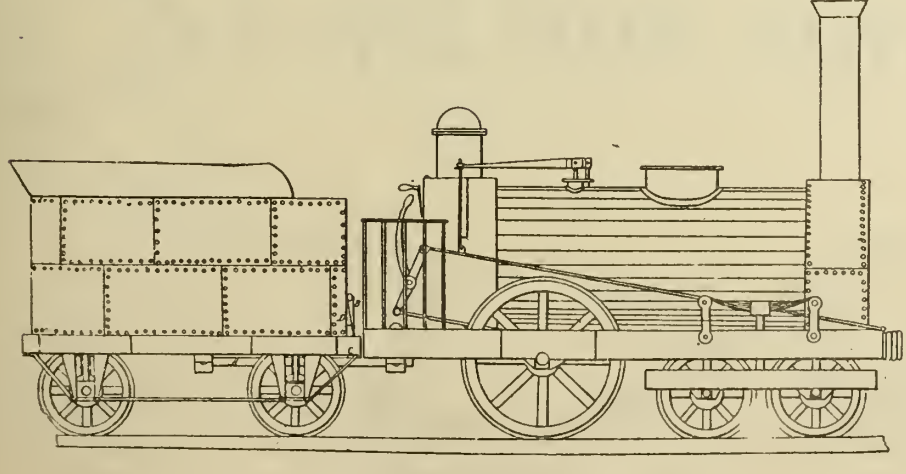
The specification describes the construction and manner of operation of the traction increaser in the following terms: "The mode which I have used, and found to answer perfectly in practice, is simply to connect the car, or tender, next the engine, to the engine by a strong iron bar, or lever, one end of which is bolted to the under side of a cross timber in the frame of the car, or tender, a little back of the centre, and which lever extends under the frame of the tender to the end of the frame of the engine and into the iron which, together with the drawing bolt, secures it to the engine.

"Transversely to this lever, I attach to the end of the tender next the engine, two levers, so that their fulcra shall be six or eight inches on each side of the main lever, or drawing bar. These levers have a jaw, or pivot, five or six inches in length, directly over the main lever, and should be about 4½ feet in length.

"When the increased adhesion is wanted, the engineer has only to place his foot upon the ends of these levers and press them into a hook, or groove, for that purpose, on the corner post of the tender; and a portion of the weight of the car, or tender, next the engine, is thus thrown upon the driving wheels of the engine; and when the increased adhesion is no longer wanted, this weight is detached by simply loosening the ends of the levers."

In his report of October 30, 1835, Mr.

(Continued on page 100)



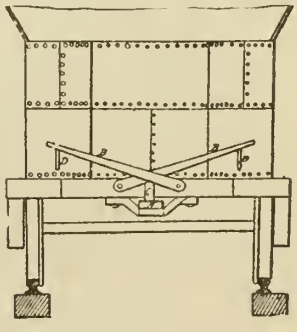


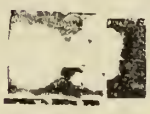
FIG. 8—A DRAWING OF THE MILLER PATENT.

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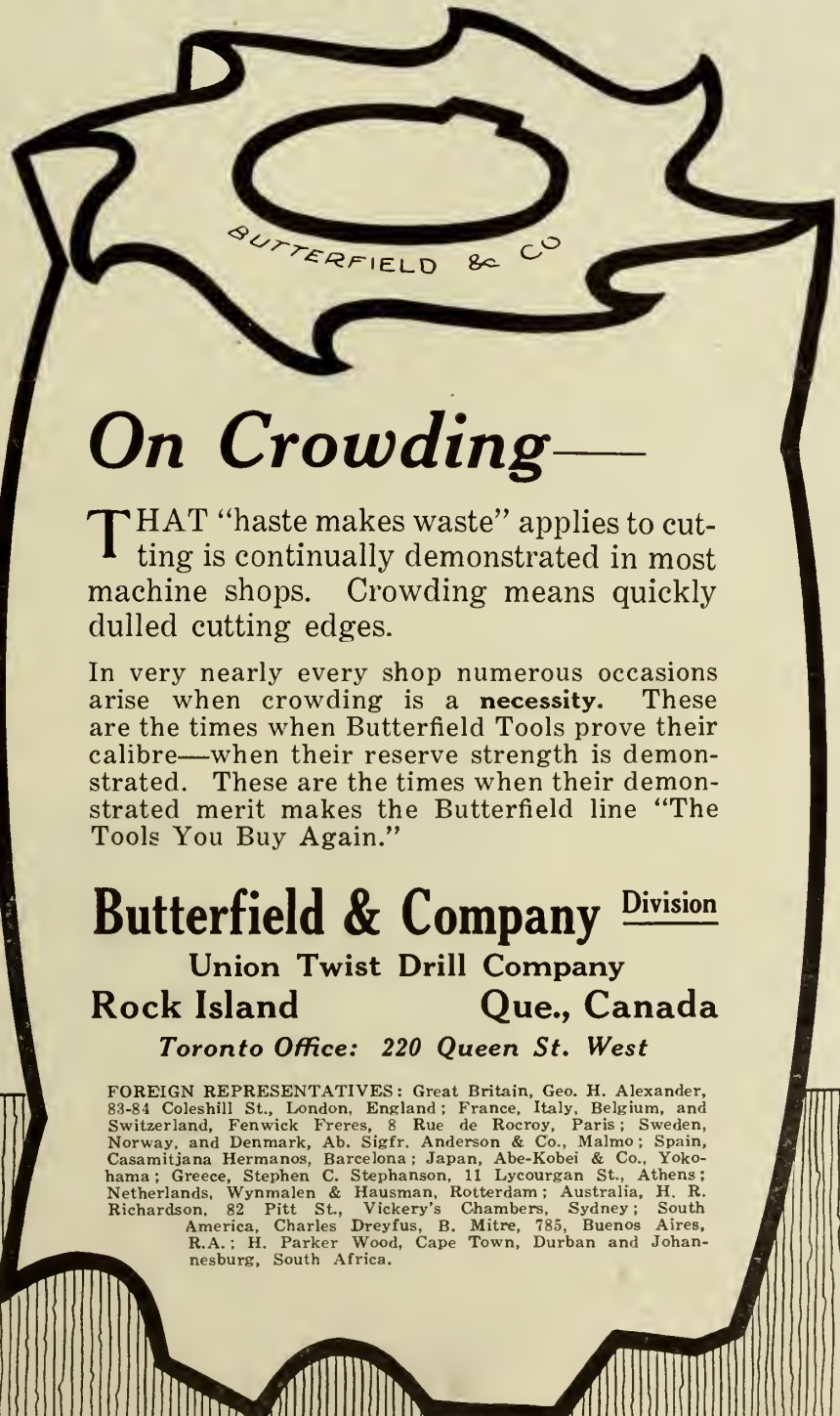


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If interested tear out this page and place with letters to be answered.



WELDING AND CUTTING



Facts Regarding the Oxy-Acetylene Process

The Examples of Work Shown with Data Pertaining Thereto, Have Been Compiled by Author from Information Applied by L'Air Liquide Society

By J. H. MOORE

THE fundamental principles of oxy-acetylene welding are easily understood, and when one has already a rudimentary knowledge of the physical and chemical properties of metals, it does not take long to become proficient in the work after some experience has been acquired in the use of the necessary apparatus. The two gases, oxygen and acetylene, are well known and need no explanation. Oxygen is compressed and supplied in steel cylinders. Acetylene is supplied in dissolved state in cylinders first filled with a porous material soaked with acetone, which removes any risk of explosion, or may be obtained from a suitable generator.

Acetylene, when burnt in equal proportions with oxygen produces a neutral flame (that is, neither oxidizing nor carbonizing), of an estimated temperature of over 7,000 degrees Fahrenheit. All metals under the direct influence of this intensely hot flame melt rapidly. Suitable additional metal is added to fill up the groove between the two pieces and results when allowed to cool in a perfectly homogeneous joint of practically equal strength to the metal adjacent. The gases pass through regulators specially designed to reduce the pressure of gas emanating from the cylinders to a suitable working pressure, afterwards passing through special flexible tubing into the body of the blowpipe in which they mix in predetermined proportions.

Perfect results, however, can only be obtained by the use of perfect apparatus. In selecting apparatus it is essential that only the best is purchased. The question of cost therefore should not be the only consideration to enter into when the question of purchase is considered. So called "cheap" (or inferior) apparatus is not only detrimental to good work but represents an element of risk to the operator, and a few dollars presumably saved on the first cost would be more than lost the first time of using it; besides being wasteful in the use of gases, with the likelihood of discredit to the worker or his employer arising in the future.

On the other hand, when perfect apparatus is used the results obtainable are only limited to the skill of the operator. The cutting of wrought iron and steel is based on the well-known fact that when iron is heated to a high temperature in the presence of pure oxygen it rapidly burns, and forms oxide of iron, which melts at a lower temperature than the metal itself. The apparatus for oxy-acetylene cutting is similar to that used for oxy-acetylene welding except that the blowpipe or cutting torch is so constructed that a stream of pure oxygen acts on the heated metal and oxidizes it. The resulting oxide liquefies almost simultaneously and is blown away by the action of the blowpipe. This process of oxidation and liquefaction is rapidly repeated until the metal is severed by a clean and narrow cut, either through its entire depth or such part of it as may be required.

Cutting by Oxy-Acetylene Process

Cutting all thicknesses of wrought iron and steel by the oxy-acetylene process has now become a common method. Not only is the cutting by this process rapid, but it is also very much cheaper in consequence of the enormous saving of time and labor. It is practically as easy for the operator to cut a circle or any other design as it is for him to cut straight across, which is all that can be done, of course, by sawing.

There is hardly any limit to the thickness of steel, etc., which can be cut by this process if proper equipment is used, and the many machines that are on the market designed for the cutting of heavy thicknesses of steel, working more or less automatically, and the success they have attained, bear testimony to the essentialness of such a process.

For ordinary purposes, where the metal



FIG. 1—A GOOD EXAMPLE OF HOW THIS STYLE OF WELDING CAN BE USED TO ADVANTAGE.



FIG. 2—THIS ENGINE CYLINDER WAS REPAIRED IN 48 HOURS.

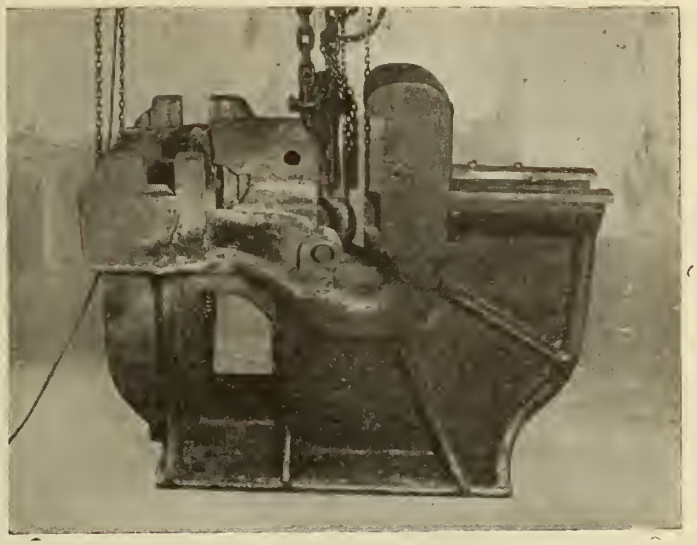


FIG. 3 A NAIL MACHINE THAT ANSWERED TO THE ROLL CALL IN 48 AFTER DISABLEMENT.

is only a few inches in thickness the work is very easy and requires no mechanical assistance; in fact, a man can become an expert operator after very little training.

The question is sometimes raised as to whether cutting by the oxy-acetylene flame has any harmful effect on the material, and the answer is emphatically, No! Mr. P. F. Willis, who is an impartial authority on the subject, makes the following allusion to this subject in his book "Oxy-Acetylene Welding and Cutting." "Is there any detrimental change in material when cut with oxygen?"

No. On high carbon steels there is a slight softening of the metal for a distance of about ⅜ inch from the cut, due to the annealing effect of the heat. Numerous tests have been made and all bear out the above assertion. The results of one such test may prove interesting. A steel plate ¾-inch thick and 14¾-inch long was used.

	Test No. 1 Original Stock Before Cut	Test No. 2 After Cut
Tensile	47,620 lbs.	50,110 lbs.
Elastic Limit	31,640 lbs.	29,930 lbs.
Elongation	33%	33%
Reduction of Area	35%	42%

It is an advantage, when cutting, to have the blowpipe perfectly steady, with the tip at a distance of about ⅛-inch from the surface of the metal, for ordinary thicknesses.

Cutting discs out of steel plate is a comparatively simple process, and requires very little skill on the part of the operator. Some concerns supply a circular cutting guide which enables the operator to cut a perfect circle of almost any diameter with no more effort than is required to control the blowpipe. Cutting heads off rivets when repairing boiler and structural steel without injury to the plate, is also a particular advantage of this process. By cutting off the head, it only requires a tap of the hammer to knock out the rivet. In certain instances, this is the only practical method of taking out rivets, especially in places where they are inaccessible to a hammer and cold set.

For cutting out discs and intricate designs in iron and steel this method is especially valuable. Cutting up scrap and dismantling steel structural work is also an important field for the oxy-acetylene process, and is the solution to many problems of a similar nature, such as clearing up wreckage after a fire, train disasters, etc.

Its Efficiency and Economy

The time was, and not long ago, that when an important part of machinery broke there was no alternative but to replace it by a new part if procurable, or patch it up by some crude method which usually could be depended upon to give but temporary service only. Sooner or later the time would come when a new part had to be obtained or the machine discarded and condemned



FIG. 4—A FEW HOURS MADE THIS FACE PLATE AS GOOD AS NEW.

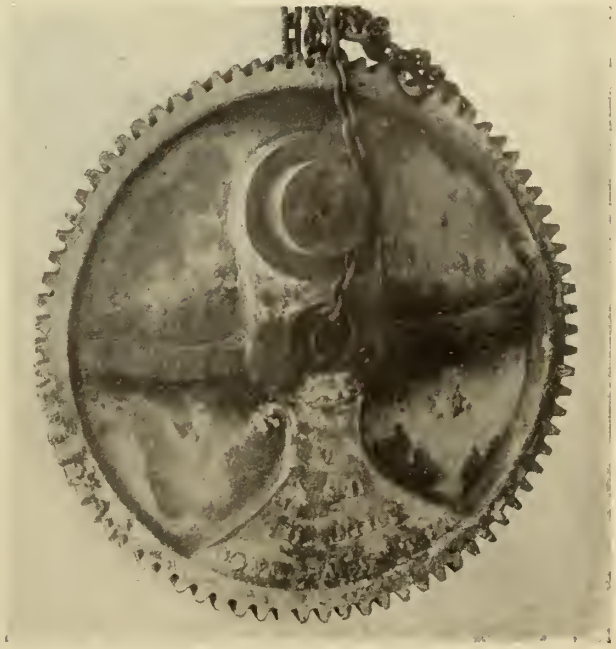


FIG. 5—A FEW HOURS WAS ALL THAT WAS NECESSARY TO PUT THIS GEAR IN WORKING CONDITION.



FIG. 6—THE CYLINDER BEFORE WELDING.



FIG. 7 HOW IT LOOKED AFTER BEING WELDED.

altogether, and replaced by a new one.

Probably at that time, when such machinery was comparatively cheap to buy, this might have in the end been considered economy as one could naturally get more service from a new machine than an old one more or less out of order, but with the advent of the oxy-acetylene process of welding these methods came to be looked upon as unnecessarily wasteful, and at the present time would be regarded as positively inefficient.

With the speeding up of all industries directly or indirectly concerned in the production of war material, machinery and equipment became taxed to the utmost so that when an important part or a casting became broken oxy-acetylene welding was looked upon as a highly practical and efficient method of restoring it to use again—not only from the standpoint of economy, but because it might be welded in a few hours and made practically equal to new, whereas to procure a new part would take very often several weeks, and in the case of foreign made machinery, would be altogether unobtainable.

The more the price of machinery has risen and the greater the scarcity of metal of all kinds, the more valuable the oxy-acetylene process has come to be regarded until it is now looked upon as an indispensable necessity in all industries, and for all purposes where the joining of metals is involved. There is practically no inherent weakness in the welded joint when the work is properly performed, especially on cast iron and steel. The tensile strength of a weld on cast iron is equal to or greater than the metal itself. In the case of steel, the welded part is about 90 per cent. to 95 per cent. of the strength of the metal.

Even on brass and copper, upon which welding is not attempted as often as it should be, the results are better than can be obtained by riveting or any other method of joining which are consequently rapidly being superseded by welding.

It will therefore be seen that this process holds out many advantages, especially to the manufacturer of metal furniture and utensils, cylinders, drums, containers, etc., where a joint of neat appearance and absolutely leak-proof is necessary; and where the article has to be subjected to great pressure. After smoothing off the welded part it is quite impossible to detect the joint so that it is for all practical purposes seamless.

In certain cases such as the manufacture of bakers' dough vats, where it is necessary that the article, when in use, has to be absolutely clean in every respect, the fact that there are no seams or apertures which would make it difficult for the receptacle to be kept quite clean and free from deleterious matter, the practically seamless article made by oxy-acetylene welding has much to commend it even when strength is not of great importance; furthermore, more often than not it can be made cheaper by this than any other method.

There is hardly an industry of any kind but has its own use for this process in some way, either for repairing or manufacturing, or for some other purpose incidental to either of these two. To recount them all would be quite impossible, but the following are a few of the uses to which it is most comomnly applied, and will be sufficient to give a general idea as to the many other similar uses to which it could be profitably adapted.

Railroads are saving thousands of dollars yearly and keeping their rolling stock in constant service by welding broken locomotive cylinders, drive wheels, welding cracks in fire boxes, mud rings, flues in flue sheets to eliminate leakage, broken forgings of all kinds, cracked or defective steel castings, broken flanges on cylinders, frames, crossheads, quadrants, reverse levers, etc., etc.



FIG. 8 AUTOMOBILE CYLINDER BEFORE WELDING.

Shipyards, by repairing broken cylinders, broken propeller blades, damaged engine parts, boilers, davits, stern posts, cutting manholes and portholes in steel plates, cutting up wreckage, etc. Steel and brass foundries by building up defective castings, filling up blowholes, welding cracks and otherwise saving parts which, by being somewhat defective, would be useless for the purpose required; cutting off steel gates, risers and runners, welding cracks in bronze bells, etc. Pulp and paper mills by welding broken gears, machinery parts, paper cores, etc.

Machine shops are reclaiming parts that have flaws in them, either by accident or other fault, and saving the amount of work spent on them; welding broken machinery parts, etc. Big savings are also being effected in various industries by welding high speed steel to low carbon shanks and using up every part of a tool after it has become too small for ordinary use. This admits of the whole of the high speed steel being utilized, which, owing to its high cost, is an important consideration.

Garages also have many and important uses for this process for welding broken crank cases, cylinders and water jackets, lengthening and straightening chassis, welding broken crank shafts, gear shift rods, fenders, gasoline tanks, radiators and many other broken or damaged parts but which it would take too long to enumerate. So manifold and varied are the uses for the process that it has almost come to be regarded as an axiom that, whenever two pieces of metal are to be joined, the best and most economical method is to weld them.

Believing readers will be interested in actual illustrations of work performed we show throughout this article some examples of good judgment in welding. The first of these, Fig. 1, shows a part of a handkerchief-making machine, which, together with about 100 small parts, was broken in transit. As this machine was made in France, an attempt to secure a new casting would have caused untold delay. The dimensions of all the slots shown were in millimetres, which made it still harder to even contemplate making a new pattern. The expense of replacing, not to speak of delay, would have been considerable.



FIG. 9- THE CYLINDER AFTER WELDING.

The problem, however, was easily solved. The casting was welded by the oxy-acetylene method, and restored to use again within a few hours. It was practically equal to new, and the cost of

(Continued on page 100)

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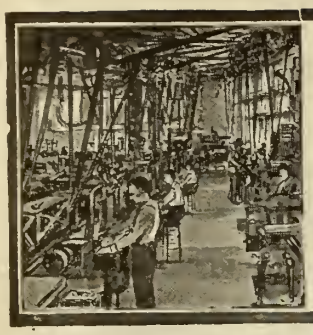
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Something that keeps square without a policeman watching it.
A product that is said to use less steam in the long run than the steam engine.
How to keep heat under accurate control.
Something that is said to positively lower industrial costs.
How to obtain various kinds of lines.
A demand that is said to increase daily.
A machine that can be rigged up in three different ways.
That it takes 25,000 of one article to produce one of another in some cases.
That two men can do the work of eight, providing they work with the correct material.
Something that can be worn long hours at a stretch without discomfort.
That benefits are derived from correct distribution of metal in machine design.
That it is possible to bring joy to a machinist's heart.
A talk on engines that is helpful and interesting.
That you can secure a machine capable of handling various jobs without a change of tools.
That faith in Canada and its industries can make a firm expand.
That all the diamonds are not used to decorate ladies' fingers.
Sixteen important helps to Canada that are all members of an equally important organization.
What to do if you have a pumping problem.
How to get out from under the tax burden.
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How to assure a future of steady, dependable output.

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DEVELOPMENTS IN SHOP EQUIPMENT



UNIVERSAL GRINDER

The Jones & Shipman, Ltd., Leicester, England, have placed on the Canadian market the universal grinder shown in the illustration. It is known as their model 273 and is used for both internal and cylindrical grinding. There are several features of interest which are herein described.

The columns are high grade castings of rectangular section designed to afford maximum rigidity. The wide spread bases have three-point bearing contacts proportioned to eliminate vibration. The body carries the reducing gear and change feed for the sliding table, together with the clutches for the automatic change feed. The automatic reverse is enclosed in a box on the front. The table is pivoted on a secondary slide provided with a hardened central spigot, and is adjustable for taper grinding by means of a hand-wheel and screw. The setting is registered on a scale reading the taper per foot and the angle in degrees. A T-slot is planed the full length of the table to hold any special work, in addition to the angular slot carrying the work-head and tailstock; the work-heads are pulled up by this angular slot against the master straight-edge in front of the table, ensuring perfect alignment.

The table slide is always covered and guards are provided to exclude grit and water. As it always travels over the full length of the slide-ways of the bed, such slight wear as ultimately occurs is evenly distributed and accuracy is maintained over the whole length. The traverse is automatic with eight variations of speed, lowest 15 inch, highest 109 inch per minute. The wheel head is of massive construction, ensuring a perfectly steady running wheel. The wheel spindle—of special case-hardened steel—is finished to a high degree of accuracy. The bearings are of phosphor bronze, lubricated with wick feed, with double ball thrust for taking up all end play, and exceptionally well protected against dust. It is bolted on to the swivel table on the cross slide, and can be securely locked in any position. It also carries an adjustable driving bracket for the drive to the internal spindle. The head carrying the internal spindle is a separate fixture mounted on the same swivel table, and is of suitable dimensions to carry super high-speed spindles. The design throughout is carefully proportioned to eliminate all vibration.

The cross slide carries the wheel-head and also the internal grinding head, and is arranged to swivel in a complete circle enabling either the external or internal wheel to be brought into use without disturbing the work; its movements are fully graduated. The cross feed to the wheel head is automatic and variable, and is rendered very sensitive by an arrangement of counter-weighting the cross slide. It is fitted with accurate and reliable trip mechanism for sizing the work. Automatic sizing of work is attained by setting the adjustable knock-out to the required diameter, and engaging the automatic cross feed, which is instantly stopped when the wheel has advanced the predetermined distance.

The work head is fitted to a graduated swivel base on the table. It carries a double pulley to give fast and slow speeds for a large variety of grinding, and is arranged to carry a face plate or chuck, and may also be locked for dead-centre grinding. The tail stock or back centre is of massive design, lever operated, the compression of the spring being so arranged that not only is it adjustable for light and heavy work, but can be set for any given position, thus preventing the centre from pressing into the work more than the desired amount. Its adjustable spring tension accommodates the expansion of the work when grinding. The water service is incorporated in the machine; the water taken is easily accessible for cleaning purposes. A high grade geared pump forces a heavy volume of coolant through flexible armored hose to the adjustable nozzle attached to the wheel guard, the return being through inclined water ways and strainer to a removable filter tray, thence over a weir to a sump and tank.

Lubrication. A sinple and efficient



GENERAL VIEW OF THE GRINDER.

system throughout enables every working surface (which is not already self-oiling) to be readily supplied with oil with a minimum of trouble. Following are the chief dimensions: Capacity between centres, 12 in. dia., 24 in. long; table traverse, 24 in.; table taper adjustment, 30 deg. included; height of work head centres, 6⅛ in.; working surface of table, 43½ in. by 6 in.; cross traverse of wheel slide, 6½ in.

Number of work speeds, 8; number of wheel speeds, 3; size of disc wheel, 10 in. by 1 or 1½ in.; countershaft driving speed, 500 r.p.m.; horsepower, 4½; floor space, 96 in. by 52 in.

FILTRATION AND STERILIZATION

To the man who is not vitally concerned the matter of machine tool lubrication may not appear of much importance. On the contrary, it is of proven importance, otherwise there would not be the demand for such a large number of different cutting oil liquids and compounds.

It was not so long ago when the ability to increase production by liquids applied to cutting tools was recognized and the initial steps taken along that line. Water was the first liquid tried, used as a stream feed, or provision made so it would be allowed to trickle upon the tool and work. A little experience in this way proved that a mixture of soda and water was more satisfactory all around, as the tendency to rust and corrode was largely overcome.

The evolution of machine shop practice, requiring high speed tools, carried with it efforts for extreme accuracy in machining and the element of increased production. With the speeding up of tools it was readily recognized that in order to keep down operating costs and produce a product of the highest quality, it would be necessary to use a cutting fluid which had not only the cooling properties necessary to absorb excess heat, but lubricating qualities as well, to increase accuracy, decrease the power consumed, and at the same time speed up production.

With the production of a cutting oil which would serve the double purpose came the increased cost and this item must, of necessity, be kept at the lowest possible figure, otherwise the product could not be marketed. It was, therefore, apparent that an equipment which would filter and sterilize the liquid would eliminate the necessity of throwing the used oil away. This method would reduce cutting oil expense and still promote high speed operation.

The S. F. Bowser Company, Limited, oil storage and filtration engineers, Toronto, are out to meet this need and have designed a filtering and sterilizing system which will soon be placed on the market. The illustration gives a good idea of its appearance and construction. These embody the tried and true principles of screening, precipitation, filtration and sterilization, all combined in a commercial and practical manner. This class of filtration is not a venture or experiment, and the company have had systems, essentially the same, in service for several years, which are giving the very best results.

An installation of this nature will naturally increase the life of the cutting tools, decrease power consumption, permit higher operating speed, increase accuracy, give better lubrication and save throwing away oil which has been used. By this conservation a better grade of oil can be used—one which will not foam, rust or corrode the work or tools. While the filtering process, which is automatic, is under way, the oil is also sterilized, thus eliminating obnoxious odors and preventing infection, thereby preserving the health of the employees.

The systems are so designed that they can be adapted to conditions prevailing and arranged to accomplish the work required. From the machines and chip separators the oil, either by gravity or special provision, can be delivered to the filter and sterilizer which automatically removes foreign matter and sterilizes the fluid. After going through a series of compartments, screens, filtering devices, etc., the liquid is delivered to the filter tank, which acts as a temporary storage. From this tank the oil can be returned to the different machines the same as new oil and used again.

NEW THINGS IN MACHINE TOOLS

ADJUSTABLE WRENCH

The Allen-Diffenbaugh Wrench & Tool Co., Baraboo, Wis., have marketed an adjustable wrench which automatically grips a nut when the handle is pulled. It is made in several sizes from drop-forged steel and has jaws that are machined and hardened.

UNIVERSAL CLAMPS

The Burvin Co., Inc., 87 Warren Street, New York, are marketing tools known as the Force universal clamps. These are made by the Black Rock Mfg. Co., Bridgeport, Conn. in several sizes adapted to hold irregular work on milling machine tables.

PLANING MACHINE

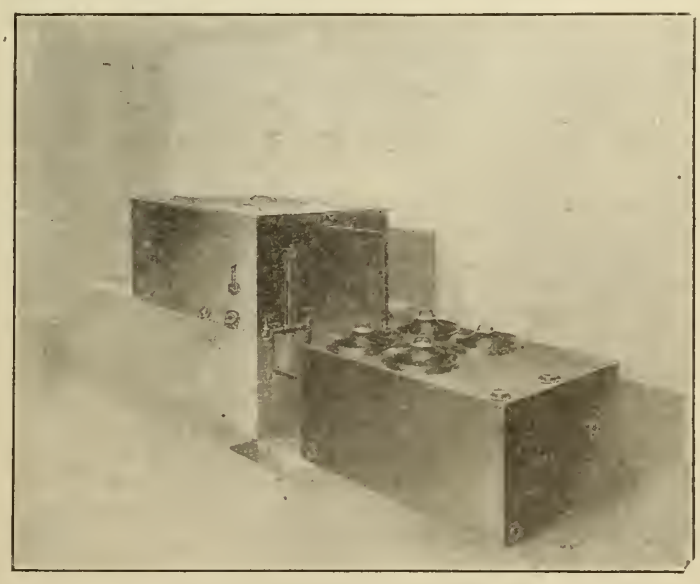
The Powell Machine Co., 245 Stafford Street, Worcester, Mass., are marketing a 48-inch x 17 foot belt-driven planing machine of the high-speed type. The feature of this machine is the accelerating drive which overcomes many of the difficulties so far met with in designing planers of the heavy type.

OIL COOLER

The Griscom-Russell Co., 90 West Street, New York, have placed on the market a device known as their multi-whirl cooler. The device is designed for cooling the oil used in the lubrication of turbine bearings and reduction gears, or the quenching oil used in the heat treatment of steel. It is claimed that by means of this device the oil can be maintained at the proper viscosity for efficient results.

STARTER FOR MOTORS

The General Electric Co., Schenectady, N.Y., have issued an automatic starter for use with squirrel cage induction motors driving lineshafts, pumps, compressors, and similar devices. The starter is operated by a push button or by a float switch, pressure governor, or some similar automatic accessory.



VIEW SHOWING THE FILTRATION AND STERILIZATION SYSTEM.

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These Changing Times

THE business community in Canada can well heed the remarks of many of the best thinkers on this continent who are trying to bring home the fact that there is a real and vital responsibility resting upon it right now in maintaining a substantial activity in operations during the period of price adjustment.

A policy of moderation and sympathy is needed. The forcing of any man or of any company to the wall should be avoided if there is any honorable way out of such a move.

Manufacturers of either raw, semi-finished or finished material should do their utmost to prevent unemployment, and in this they should have the co-operation of every employee.

The man in the shop should recognize that the management has a real problem on its hands now. Financing is not easy—it is hard, especially for firms that have not been in existence long. There are managers and presidents who are drawing hardly anything at all in the way of salaries at present. The business is simply taking it all, and their optimism for the future and their determination to participate in the development of months to come keep these men in a state of suspended, if not actual poverty.

Occasionally one hears a remark to the effect that "the worm has turned, and we—the management—are going to have our turn now. The men in the shop have run this place for the last four years and we are going to let them know now what a pinch feels like." This attitude is not general, but it exists in some places. Its application to shop management now would be the veriest nonsense.

Nursing a grudge is wasted energy—it will not turn out one extra casting in a year—it will not get any better results in the tool room or the machine shop—neither will it make any other department any more capable or efficient.

There should be a reasonable policy to bring about as much employment as possible. Unemployment is not desirable at any time—it strikes too quickly and too surely at the homes, at the wives and children.

The Canadian trade has so far kept its head fairly well in the matter of cancellations. It is highly desirable that this attitude should continue. An avalanche of cancellations, were they allowed, would start a circle of trouble so vicious that one could hardly measure the element of danger it contained.

All things considered, there is a fair volume of business passing in Canada. It is not to be expected that much expansion will take place until prices and values find new working levels.

The business community in Canada is going through these changing conditions successfully.

Common sense, confidence in the future, an honest day's work and a fair amount of actual and honorable sweat will put us across safely and give us a start on an era of development such as we have not witnessed heretofore.

Another Harmless Boiler Explodes

ONCE again has a boiler, used on a farm for the purely agricultural purpose of threshing proved that it is not exempt from the physical laws that govern other steam-containing, or pressure-containing vessels, though it is free from legislation. It proved this elemental fact by the very impressive means of blowing up, fortunately without hurting anybody. The men in the immediate vicinity had a very lucky escape, and those who were further away from the firing line were also fortunate, as some pieces weighing several hundred pounds were reported to have landed several fields away.

It shows surely a lack of consideration, or a sense of the fitness of things, on the part of these boilers to blow up when several successive governments have decided in their wisdom that these boilers cannot blow up, and are perfectly harmless domestic pets. The process of reasoning which decided that because a boiler is on a farm it is going to act differently under given circumstances than a boiler in an industrial establishment is not very clear to the ordinary mortal. Furthermore, the boiler on the farm is supposed to be possessed of sufficient intelligence to enable it to perform its functions without the aid of any skilled help. It is very likely that the real reason of the exemption of boilers on the farm from the Steam Boiler Act was on account of the farmers all possessing votes, and the fact that a farmer suddenly called upon to pay inspection fees, and probably higher wages to skilled help, would have emitted a howl that would have been heard uncomfortably in Queen's Park.

Now that we have a Government composed largely of farmers it is hardly likely that they will pass legislation that will cause them to be under this necessity. We must therefore submit with what degree of patience we can to the spectacle of occasional boiler explosions on farms, with or without loss of life, until someone who is not afraid of adverse votes gets a measure put through that will include farm boilers.

Our own opinion is that if there is any place on earth where a steam boiler should be subject to rigid inspection, it is on a farm, because anyone who has noticed the way many a farmer treats his farming implements can form a fair estimate of the way he will look after such a thing as a steam boiler.

We have pointed out from time to time in these columns the potentiality of danger that lies in any vessel containing a quantity of water under high steam pressure, and the fact that it was of relatively small size did not eliminate the danger. If one were to take the kitchen kettle and carefully seal the spout and tie the lid on after filling it with water, and then place it over the flame of the gas heater or the coal fire, it would probably blow the kitchen to pieces. The smallest boiler is much larger than the biggest kettle. Why should it be exempt?

Machinist Should be Given a Variety of Work

By T. DALY, Works Engineer International Harvester Co., Hamilton.

THE status of the all-around machinist has always been an interesting subject and readers no doubt read with interest the views of R. W. Gifford in our October 7 issue. T. Daly, works engineer for the International Harvester Co., Hamilton, Canada, has his own ideas on this subject, and here they are:

To my mind the all-around machinist is not passing out completely, but I do believe that the modern machine shop methods do not produce the same proportion of all round men as formerly. The tendency of to-day is to develop mechanics who are, more or less, specialists. The volume of modern industry and keener commercial competition have quickened the effort for increased production. Production is influenced by three important factors: the division of labor, the co-operation of labor, and the use of machinery.

Primitive man lived in a state of sturdy independence. He made his own weapons of defence, hewed his own log canoe and ground his own corn. When civilization came and community life developed, men chose definite trades. The blacksmith or armourer made implements and weapons, the carpenter worked in wood, and the mason built in stone. This division of labor was thus a natural outcome of the growth of communities. To my mind the advantages of divided labor are as follows:

1. Increased skill in the workman; as for example, in the tempering of tools by a toolsmith. 2. Saving of time; as in operating a crane, the slinger securing the load and the driver controlling the hoist. 3. The tendency for the workman, when encouraged, to improve the machine or method, if his mind is concentrated on his work. Many improvements have thus originated. 4. Greater efficiency of the workman by being kept to the work he can do best; it would be wasteful, for instance, to keep a good pattern maker working on rough carpentry.

Against this it may be contended that: 1. The worker's pride in his craft is often destroyed by its subdivision into simple and monotonous processes, and he may feel no responsibility for the product as a whole; hence much inferior workmanship. 2. Excessive monotony tends to make the workman a mere machine, and does not develop his intelligence. 3. If his task is changed, his usefulness is often lost. 4. The function of industry being to provide the material means for a good social life, the undue subordination of human beings to any mechanical system should be resisted. By the co-operation of labor the combined action of numbers can accomplish what one man alone cannot do; as in the erection of a steel bridge.

On the use of tools and machinery, all industry is dependent, for the rudest agriculture could not be carried on without a spade, nor traveling at 60 miles an hour on the railway without an engine. During the war the necessity of the times caused a further subdivision of labor. Unskilled help was brought into the munition industry, given a brief training on special machines, thus producing numbers of specialists who are just "machine hands." Had sufficient trained men been available this work would have been more in their hands, but under the circumstances the real machinist had the better class of work, and the making of safer and quicker tools and machines for use by unskilled operators. This influx of unskilled labor into the mechanical field makes the machinist imagine his services to be underrated.

Will It Lower Standard

If asked the question, Will the passing of the all-round machinist lower the standard of his calling? I would say this, that the man who has served an old-time apprenticeship will regretfully nod his head. He recollects how in the old days he used to mark off his own work, do his own simple forging, or chalk on a board how he wanted the blacksmith to make it. He would do his own shaping, turning and drilling and finally assemble the work at the bench. To the individual this is much more interesting than one particular piece of work, for it has the spice of variety about it, but, of course, it cannot be termed efficient as to production. So it has yielded to the methods brought about by better machinery and preciser measuring tools. The old-time all-round man, however, may now be kept to one machine or process, and thereby be prevented from realizing the full value of his experience. On the other hand, the machinist who specializes becomes more rapid and accurate and probably drifts into some phase of work at the lathe or milling machine or at the bench, where he finds ample scope for his manual skill, his eye and his brain.

There is, and always will be, a place for all-round machinists; in the small shop, where there is not work enough to keep a man for each kind of machine; in the repair shop of larger works, where he may have to do anything from facing a slide valve to hanging a countershaft; and on experimental work—in fact, wherever there is frequent variety. For the position of foreman, a man with a broad experience is generally required, and here the all-round man will serve better than the specialist, provided that he can accept responsibility. It is also generally agreed that the bench hand has a wider outlook than the man at the machine, for it falls to his lot to interpret the drawings, sublet the machine work, and assemble the parts.

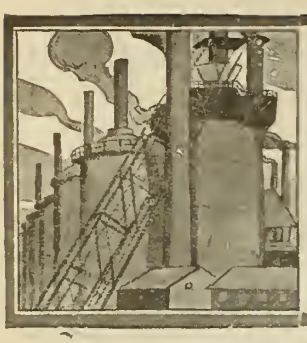
On the whole, therefore, it does not appear to me that the standard of the machinist trade is being lowered, as the matter tends to adjust itself. Relatively fewer all-round machinists are being produced, but proportionately fewer are required, and the standard of the work of the average machinist is continually being raised by the demand for more accuracy in machine manufacture.

Can We Improve Present Conditions

Can we improve present conditions or raise the standard of the machinist or toolmaker? is a question which could be asked. To this I would say, that to remedy the present tendency to over-specialize, the machinist should be given as much variety of work as is consistent with good production, to maintain his interest. Much can be done by employers to cure the tendency and prevent too-early specialization, by having a well-regulated system of apprenticeship. There is no doubt that love of the vocation in which a man is engaged breeds both efficiency and contentment of mind. Hence boys of good education who are interested in things mechanical should be encouraged to serve a definite term in learning the machinist trade. They should follow a schedule of changes from one machine to another, and have a good spell at the vise.

Technical training should not be undervalued, and the youth who acquires some knowledge of mathematics, mechanics and drawing in his own time will value it more than if it is given gratis by his employers. The wages during apprenticeship should have sufficient margin above the cost of board and lodging, so that the apprentice will not be tempted to drop his prospects of becoming a skilled mechanic with chances of promotion, for the higher initial pay of the machine hand on piece work.

By the end of his time the apprentice will have discovered his preference for some machine or class of work; or, if his inclination for the technical side is strong enough, he may push his way into the realms of machine design. In any case his varied apprenticeship will give him a good foundation for a successful career in a skilled and useful calling.



MARKET DEVELOPMENTS



Premium Steel Mills Let Down the Prices

Some Business Going Their Way for Spot Delivery, But the Price is Better Than for Some Months—Cancellations Are Asked for in Some Lines, But Are Not Generally Being Granted.

THERE are signs that the deflation of prices is settling more seriously on the iron and steel markets than for some weeks past. Not that there has been any sudden drop, but there is an eagerness to sell now that has been absent for some time past. The premium mills in United States are still selling steel in Canada, but they are doing this at a much more favorable price than formerly.

Cancellations are asked for in some lines, but about the only chance of having a cancellation recognized is when shipment has been delayed so long that it has become unseasonable. In that case consideration is often given. Otherwise requests for cancellation are receiving little sympathy. The trade holds that, were they allowed, it would leave a lot of unsaleable material on hand. The policy of no cancellation is being adhered to in the iron, steel and tool field in almost every case. One moderation is that some of the firms will defer shipment to anything within reasonable time, if by so doing they are going to benefit their customer. In many cases firms report that they have no requests for cancellations.

The fact that the National Machine Tool Builders' Association is meeting about a month sooner than scheduled is seized upon by many critics to indicate that there will likely be some announcement following such a gathering, although the association does not exist for any such purpose. Some of the builders have little business left on their books. In Canada machine tool builders are still fairly well employed, especially those engaged on heavy work.

The scrap metal market in Montreal was cut down this week on all lines, but even at the new figures there is nothing more moving. The new metal market is easier in many lines, and reductions in prices have been made at selling points.

Reports on collections vary. Some firms tell of trouble in getting their money, even from large and substantial companies, while in other cases the financiers will tell you that they have no trouble at all in this matter.

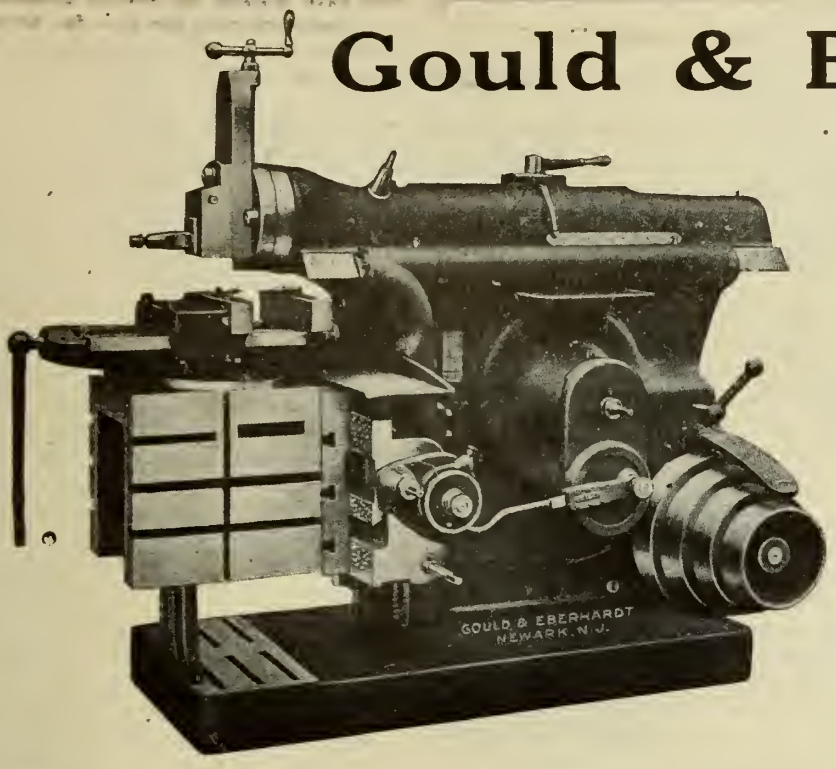
MONTREAL SCRAP METAL PRICES ARE CUT; BUSINESS STILL DULL

Special to CANADIAN MACHINERY.

MONTREAL, Nov. 4.—There is little doubt that the present easing of prices on many commodities is the commencement of that period of readjustment that the trade, and the public generally, has been looking forward to ever since the signing of the armistice. At different times during the past two years there have been developments that gave promise of a return to something like pre-war conditions, but the abnormal requirements for all classes of materials, which were excessive during the war period, continued throughout the succeeding year and showed little abatement until a few months ago. Trade conditions are now taking a turn where a lowering of prices becomes almost a necessity, but many circumstances combine in making it almost an impossibility to take drastic action in reducing quotations. The first real evidence of price cutting was reported recently when one of the mills in the States offered plates at $1 per ton less than they could be purchased elsewhere. When mills are openly taking an attitude of this nature it apparently foretells an early adjustment of prices to levels more in keeping to existing demand. Before any marked reductions can be made in steel prices it will be necessary for all concerned to co-operate in bringing about a fuller knowledge of what is required in removing the obstacles that at present prevent any marked reductions in the metal industry. There is a tendency on the part of labor to take a more reasonable view of conditions and production per man has shown an increase during the past few months.

Dealers Adjusting Prices

Steel mills have reached the point where actual competition is more than a by-word. Supply and demand are becoming real factors, with supply surpassing the trade requirements, the logical consequence being a marked trending to lower levels. Whether these reductions will be heavy or light is, at present, an unknown quantity, but the solution apparently hinges on the attitude of labor as to the question of wages. That labor is anxious to see a reduction in the cost of living is a well understood fact, but without their co-operation it is virtually impossible to establish a permanent basis of readjustment, as the present cost of production prohibits any excessive declines in the cost of producing nearly every necessity of industrial and domestic life. The pendulum of trade is swinging with considerably more uniformity as the supply of materials, which has been more or less restricted during the past year or so, is fast becoming normal. The sheet situation, since the collapse of the motor industry, has rapidly adjusted itself, and at the present time the supply of sheets, with the exception of brights, is almost adequate to trade requirements. Black sheets, 28-gauge, have declined, and local quotations are on a basis of $10.50 per hundred pounds. Plates are quite plentiful with delivery good; warehouse stocks may be had at $6.50 for 3-16 inch, and $6 for ¼ inch up. Tank plates, Pittsburgh, are now quoted at $3.50 and dealers here are revising prices to conform to the new American base. Boiler tubes are still scarce and prices are firm.



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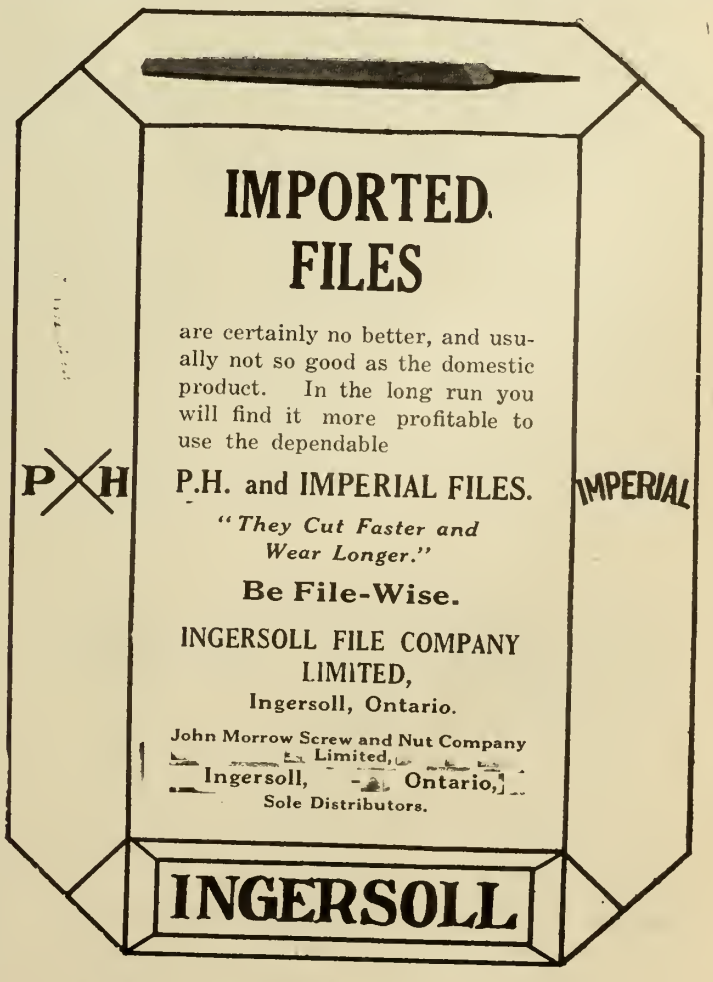
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If interested tear out this page and place with letters to be answered.

Conditions in the general industrial field are reflected in the metal market and price declines are in order. The quiet character of the demand has become additionally emphasized, and the present trading is quite listless. The local trading has decreased despite the lower price levels, and this is due to the lighter demand together with greater available supply. While dealers are still of an optimistic turn of mind there is a feeling that the remainder of the present year will see still further readjustment of conditions that will tend toward temporary trade depression. Quotations on copper have declined about 3 cents per pound. Lake is quoted at 21 cents, electro at 20½ cents, and castings at 20 cents per pound. Tin is now selling at 50 cents, a decline in a couple of weeks of 4 cents per pound; demand is lighter. Spelter is firm at 9 cents with a tendency to weakness. Lead is weak and requirements light; dealers are quoting 8¼ cents per pound. Antimony is down 1 cent to 8½ cents per pound. Aluminum is steady at 36 cents per pound.

Prices Decline on Light Demand

Aside from light local activity on the part of iron foundries, the old material situation has little of an interesting character and trading is exceeding light, almost to the point of being stagnant. The price decline has been little inducement for the consumer to come into the market as his requirements do not call for large quantities of scrap. The movement of old materials is dependent on the activity maintained in every class of industry, and with this activity showing marked signs of falling off, the requirements for scrap are relatively reduced. Dealers here anticipate a quiet period until the turn of the year, and do not look for any heavy buying until well on toward the spring. All lines of scrap have been marked down by local dealers. Coppers are now quoted at 12 cents for light, 15 cents for heavy and wire. Brasses are down from 2 to 3 cents per pound. Price reductions are also general in steel and iron scraps, these declines ranging from 50 cents per ton on boiler plates to $4 on cast iron borings. Intermediate revisions are listed in the selected market quotations.

POINTS IN WEEK'S MARKETING NOTES

Montreal scrap metal market has been marked down all along the line, but no more business resulted, and trading there, as in Toronto, is very dull.

—

Some of the dealers are still buying from the premium mills, but the prices paid are much more reasonable; for instance, black sheets being secured for about 6.50 against as high as 7 and 8 a short time ago.

—

The National Association of Machine Tool Builders have advanced the date of their meeting almost a month, holding it early in November. Some announcement regarding prices and selling policies is expected to follow this session.

—

Some of the builders of machine tools in Canada are still well employed, and contrary to reports in the market they have not laid off men, neither have they decreased wages.

—

Small tool trade is quiet, there being few orders of any size going. Reports indicate that there may be some change in prices, especially of high speed within a few days.

—

The production of iron and steel is going down, and for the month just closed was not over 90 per cent. of the totals done in August and September.

—

Current prices for pig iron this week at Pittsburgh are: Basic, $40; foundry and Bessemer, $45. These prices show a decline, but even at these levels selling is very limited.

—

Warehouses report a good volume of business in most cases, while one goes so far as to state that the month just closed, October, was as good as any during the year.

MAKE IT HARD TO CANCEL ORDERS

Firms Believe That There Should be An Adherence to Contract Wherever Possible

TORONTO.—There are certain lines of business reporting a good turnover now, while others claim that business with them is quiet. No large sales are reported, although the wood-working end has turned in some fairly good orders. There can be no denying the fact that buyers of machine tools are asking more and more what is going to be the attitude of the builders in regard to prices. The fact that the annual fall convention of the National Machine Tool Builders' Association has been advanced from the first week in December to the first week in November gives strength to the theory that there is an anxiety to get together and discuss matters of policy, especially having a bearing on the schedule of prices. It is only natural to expect that in such an atmosphere buying is going to be rather dull.

Need New Equipment

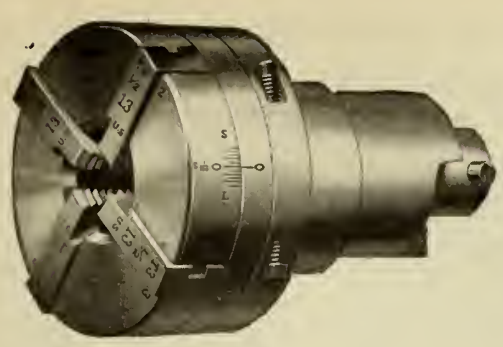
"Constructive selling in the Canadian field is hard work," is the opinion of one well-known manager this morning. "Our men have worked out several problems showing where they can give far better results than are now being secured by older methods, but it seems very hard to make much progress in this way. The Canadian manufacturer has a liking for getting the last final kick out of every old machine there is in the plant, no matter whether it pays him to do it or not. Many of the plants here will have to mend their ways if they are going to stand the pace with some of the newer plants that are being out in here now."

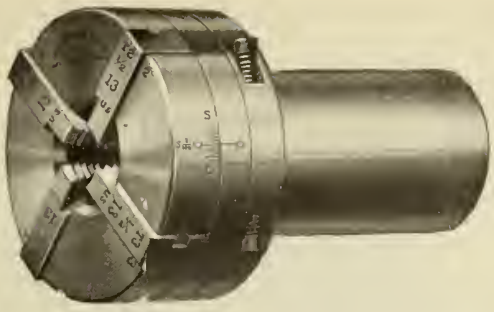
Another machine tool man, who has just returned from a rather extended survey of the field, claims that many buyers—or firms that should be buyers—are waiting and putting off coming into the market just as long as they can. They think they can secure something better in the way of terms or conditions or prices, and for that reason they are not buying. The business they have to offer is good, and it is not going to go out of existence, but it is not helping in the meantime to keep up the volume of trade.

About Cancellations

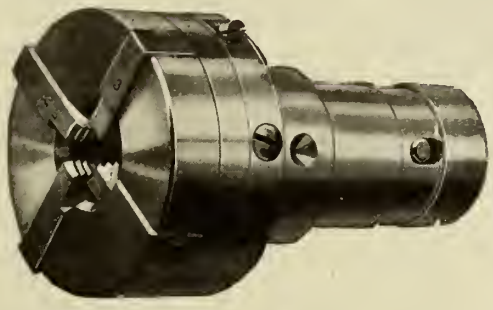
Some of the warehouses are receiving requests for cancellations, especially in business that has been on their books for some months. The policy of some of the firms is quite well marked on this point, and one that seems to take in quite a number of others was set forth as follows: "We do not accept cancellations but we will make postponements in shipments, and do anything within reason to make it easier for a man to take on his obligations and settle for them. If we were to start accepting cancellations we would be lost in a very short time. It would mean that we could go ahead and turn out material, finance it, and then, when ready to ship, we would find that our market had gone and the stuff was left on our hands. There is nothing worse for business in general than that we should make it easy to start a procession of cancellations. One cancellation is sometimes enough to start a whole lot of others in operation, and for that reason we do all in our power to keep the first cancellation in the ring from being made."

Here is the opinion of another man in the steel merchandising business: "We have some requests for cancellations but they are neither numerous nor serious, nor do we expect them to become so. Most of them are on material that has been on our books for some time past. If it is possible for us to make arrangements with our principals to cancel we will do so, but otherwise we insist that the business stand. Some of the material that cancellations are asked for has a seasonable value that is apt to be spoiled by our inability to secure it soon enough. In such a case we are willing to give every consideration to the request. Of course we try to get it held over for the next season if possible. Just a few days ago we had a request for a cancellation on a big piece that had been





Geometric Solid Adjustable Die Heads



When one uses the word "ONLY," he needs to be sure of what he is talking about. With confidence we use the word in saying that a Geometric Solid Adjustable Die Head, fitted with a set of milled dies, is the only solid die head that will back off without stripping the thread.

Geometric Solid Adjustable Die Heads may be fitted with either a releasing shank, plain shank, or with special shank for the Gridley Automatics. The releasing shank permits the head to disengage from the shank upon completion of the thread. The plain shank fits the head for use on the turret of a lathe or on a live spindle, such as a drill press.

Apart from the fact that it is not equipped with the self-opening feature or the roughing and finishing attachment, the Geometric Solid Adjustable Die Head is the same in principle and construction and will do equally as accurate work as the other styles of Geometric Die Heads.

Whatever the requirements, there is a type of Geometric Die Head best adapted to the work.

THE GEOMETRIC TOOL COMPANY

NEW HAVEN **CONNECTICUT**

Canadian Agents:

Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.
Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg; St. John, N.B.; Halifax, N.S.

If interested tear out this page and place with letters to be answered.

specially forged, and which had cost the forging plant a lot of money. There was only one thing to do in such a case, and that was to insist that the firm ordering the work should meet its full obligation, and I think that standard is generally accepted."

Most of the warehouse men report that they are doing a satisfactory business. One of them told Canadian Machinery that the month just closed. (October) would be one of the very best in the whole year. There is still a good demand for sheets, and some of the dealers state that they are still taking on material from the premium mills, but the premium mills have come down in their price to some extent. Some of them, it is said, are doing as well as 6.25 on black sheets for the Canadian trade, and on blue annealed one quotation gave 5.90.

In tubes there is still a big demand and enough bookings to take care of all the shipments that come in for weeks yet.

Some peculiar reports get in circulation in the machine tool market. This paper was told in all seriousness that one well known maker had laid off a number of men, and was generally slack. Within an hour or so a representative of this paper met one of the officials of this company on the street and put the question to him. The answer was that they had not laid off a man and that the factory was comfortably busy.

The Small Tool Business

Buyers are not taking on very much just now in the way of small tools. They are buying just what they need. In some cases one will hear of a fairly large user buying a dozen or so of a standard and much-used size of drill cutter, or tap, while in ordinary times the buying would be done by the gross. There are rumors in the market this week of some readjustment in the prices of certain lines of high-speed tools, and it is likely that an announcement will be made shortly in regard to this.

Several lists are in the market from firms that find they have on hand more stock than they can make up profitably. Buying was done at high speed in times when material was short, and there may have been more or less pyramiding of orders. Now the jobbers are being appealed to to place some of this overstock. As a general thing the jobbers just now have all they can handle, and are not likely to take on anything unless there is a very attractive price clause attached, and this is just the thing the manufacturers are trying to avoid. In many cases they know they cannot make their material up and get their money out of it in the ordinary way.

Dealers in small tools state that the general stock is getting fairly low in the country and that outside of a few industries that bought in excess of their requirements there is a lot of business that will undoubtedly come into the market before many months.

ORDERS ARE NOT COMING IN AND THE BUSINESS IS NEEDED

Special to CANADIAN MACHINERY.

PITTSBURGH, Nov. 4. — There has been a further decline in steel production, the rate now being not over 90 per cent. of the average rate in August and September. The Steel Corporation is operating its various plants as well as car supplies and fuel supplies permit, and a few of the large independents are doing almost as well, but some large independents and the great majority of the smaller mills have begun decreasing output in the past week or two, or have carried farther a decrease already begun. In a few instances mills are operating at only 50 or 60 per cent. of capacity.

With many of the mills that have decreased production the cause is simply that the mills have largely run out of orders. These are mills that sought the highest possible prices, and necessarily had to keep their order books relatively clear so as to be able to make the deliveries that brought the highest prices. When the market turned dull these mills could not fill their order books by reducing prices because sufficient business was not available at any price.

With the other mills the case is one of cancellations and postponements of delivery. The mills seemed to be sold up for several months, but cancellations and postponements have made quite a hole in the weekly requirements of customers. Mills in this position are indisposed to cut their prices, as they still have a large volume of business ahead, though not for as heavy deliveries week by week as they could make by operating full. It would be disadvantageous for such mills to cut prices, since that would jeopardize the contract business on books and would not bring enough new business in to make up.

Steel Price Changes

The independent reported a week ago as having put out a price of 2.35c on merchant steel bars, equal to the Steel Corporation price, has since withdrawn the price, and is now quoting 3.00c, without having booked a great deal of business at the cut. This illustrates how little business can be gotten by the mills that are maintaining prices. Quotations commonly run from 3.00c to 3.25c, these prices being adhered to for the sake of protecting contract business on books.

The plate mills still call 3.25c the general market on plates, but admit that it is practically impossible to obtain more than 3.00c. In actual competition this price is shaded, the lowest priced transaction lately reported being one involving 3,000 tons at 2.85c. Western mills, however, have been quoting a lower Pittsburgh basis than this, but would not ship eastward, as that would be against their freight.

Black sheets are now available from several independents at 6.50c, if the specification is at all desirable. On galvanized 8.75c has been done, but this is considered exceptionally low, 9.00c being a more common quotation. Blue annealed can be had on the basis of 5.00c, except perhaps for gauges 14 to 16.

The American Sheet and Tin Plate Company will probably open its order books before the end of the month for first half contracts with manufacturing consumers and first quarter with jobbers. On account of restricted operation the company will carry considerable business into the new year that was booked for the present half year, probably about two months of work in sheets and three months in tin plate. Customers' allotments for the half year will be correspondingly restricted, making the tonnage carried over plus the new contract equal a half year's estimated requirements. As is customary, the independents are expecting, or at least hoping, that the Steel Corporation will advance its prices on sheets and tin plates, but there is no indication whatever that any change will be made from the prices adhered to since the Industrial Board adjustment of March 21, 1919, these prices being: Blue annealed sheets, 3.55c; black sheets, 4.35c; galvanized sheets, 5.70c; tin plate, $7 per base box.

Coke and Pig Iron

Connellsville coke for spot shipment has continued its decline in the past week. Last week's report recorded a decline in spot furnace coke from $17 to $14, while at this writing the market is down to $10. Foundry coke, which had declined only slightly, has been declining more rapidly and is now down to $13. It lags behind furnace coke in the decline but will no doubt eventually show the natural differential above furnace coke, which is hardly more than $1 a ton, if as much. The decline in spot coke is due to so many furnaces having banked or blown out, or deciding to do so in the very near future, whereby shipments on requirement contracts had to be curtailed, leaving more coke to be offered in the spot market.

There is much speculation now as to where coke will stop in its decline, but there is very little foundation for making predictions. While some observers seem to think that because coke sold at $18 to $19 last August it cannot decline more than so much below that level, there is no definite percentage named as permissible under market conditions. On the other hand, coke sold at $1.50 in May, 1915, and at $3.60 in April, 1919, just after the Industrial Board adjustment in pig iron and steel prices. One theory is that coal is going to find a level at about $4, and that this will put

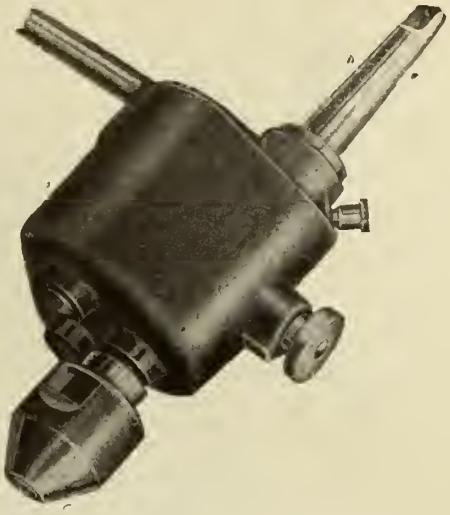
Aikenhead's

"Everything in Tools"

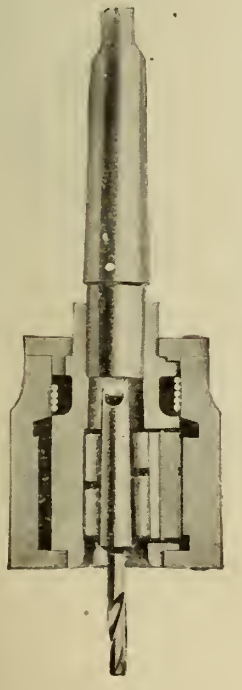
Get all your tools from Aikenhead's, "Canada's Leading Supply House." Your requirements will be promptly and carefully filled.

If you have never ordered from Aikenhead's, send your next order to them. You will find the quality, price and service right!

Full particulars of these or any other tools upon request.



Wahlstrom
Automatic
Tapping Attachment



The Wahlstrom Automatic Tapping Attachment is ten times faster than hand tapping and its simple to and fro motion frees the lands of chips, thus preventing jamming and tap breakage.

The Wahlstrom is constructed of hardened and ground parts and has nothing whatever that can get out of order. It is manufactured in two sizes. No. 1 takes taps of all sizes from 5-40 to ½-inch standard. No. 2 takes taps from ¼ to ¾-inch.

Wahlstrom Chuck
Grips the Entire Shank. Never Slips

Because the Wahlstrom Chuck grips the entire shank you may use numbers 1, 2 and 3 M. T. Shank Tools, whether they have a tang or not. The cam action is such that the resistance of the tool governs the gripping power of the jaws. Slippage is impossible.

Automatic and instantaneous in action, the Wahlstrom Chuck makes every minute and every movement profitable. The operator can make any change of tools in two seconds without stopping the spindle, simply by grasping the loose shell of the chuck.

Wahlstroms are made in two styles—one for straight shank tools, the other for M. T. shank tools—and they are both automatic. BUY THEM AT AIKENHEAD'S.

Aikenhead Hardware, Limited

17 Temperance Street, Toronto, Ont.

If interested tear out this page and place with letters to be answered.

coke at about $7, on the basis of its requiring one and a half tons of coal to make a ton of coke, with $1 for the conversion.

While everyone agrees that pig iron is going to decline until it finds a stable level, the market only makes an occasional step towards the requisite readjustment, inquiries being so infrequent that furnaces have little temptation to reduce their quotations. Basic remains quotable at the reduced price of $40, valley, reported a week ago. Foundry and Bessemer have each declined $2 in the week, to $45, valley. The decline in foundry quotations was precipitated by an inquiry for 200 tons for delivery at Pittsburgh. Several valley furnaces tried to get the order by quoting $45, furnace, or less, but a lake front furnace is understood to have gotten the business by making a still lower price. Bessemer declined to $45 without any transactions being reported, the case being simply that a producing interest offered iron at the $45 level.

One valley furnaceman predicts that pig iron will recede to the Industrial Board schedule of prices, evidently on the basis that in steel the Steel Corporation has remained on the Industrial Board schedule and the independent prices are universally expected to come down to the Steel Corporation level. Industrial Board prices were $25.75 for basic, $26.75 for foundry, and $27.95 for Bessemer, these prices being, generally speaking, f.o.b. furnace. No other producer admits that pig iron will get as low as that, the common prediction being that pig iron will drop to between $30 and $35. This probably means $30. There is good ground for argument that decline in steel prices to the Industrial Board schedule does not prove that pig iron should decline correspondingly, for the Industrial Board schedule, reflecting the philosophy that obtained in fixing prices during the war-time control, put a rather larger percentage spread between pig iron and semi-finished steel, and between semi-finished steel and finished steel, than has obtained under open market or competitive conditions.

MACHINE TOOL BUILDERS ARE PUTTING THEIR MEETING NEARER

Special to CANADIAN MACHINERY.

NEW YORK, Nov. 4.—The annual fall convention of the National Machine Tool Builders' Association has been brought forward from the first week of December to November 11 and 12. This change of dates is presumably for the purpose of giving the machine tool manufacturers an earlier opportunity to consider the present business slump so that a plan of action may be suggested that will best meet the situation.

Three questions of importance face the machine tool trade: First, the business outlook for next year; second, the question of reductions in selling price, and third, the possibility of a revision downward of labor costs.

As for the first, it may be said that the trade as a whole is very optimistic regarding conditions in 1921, but the outlook for the remainder of this year is none too good, especially as it now appears quite certain that little or no railroad buying will be done before January 1. There is a fair number of inquiries for tools from industrial plants, but prospective buyers seem in no mood to close business. Individual opinions in the trade are that price reductions at this time will not stimulate much buying. However, the pressure that has been brought to bear by some buyers, particularly automobile companies, for lower prices has resulted in serious consideration on the part of many machine-tool builders as to whether prices can be brought down. Material costs are coming down, but these reductions have not as yet been reflected to any extent in machine tool manufacture. Likewise, some plants are bringing down labor costs by insisting upon greater individual efficiency among workmen, but this reduction is offset to some extent by the fact that few plants are working full time.

While the National Machine Tool Builders' Association does not, and cannot, consider the question of selling prices officially, it is quite probable that the gathering of many machine tool manufacturers in New York this month will result in informal conferences on the subject, and the members of the association will go home with some definite idea as to what should be done to meet the present situation.

WARN USERS WHEN JUICE RUNS LOW

St. Catharines Having Trouble in Securing Power for its Industries

St. Catharines.—The local Hydro power crisis, precipitated when on account of the cold spell customers threw on their electric heaters despite repeated warnings, and burned out half of the transformers, is somewhat easier, due to co-operation on the part of consumers, which has been to an extent forced.

For two days some of the smaller factories have been cut off and an effort will be made to have the street lights reduced to half and illuminated signs eliminated.

Manager Yates, explaining how the load has been reduced thus far, said: "If at any time a reduction is necessary the signal will be flashed to all the users, as was done last night by successively pulling out the switches feeding the different sections of the city. That section which shows the least response to the signalled request will be the one allowed to suffer."

AMERICAN CO. IS NOW INTERESTED

And Reorganization of the Beaver Motor Truck Co. Has Been Announced

The announcement that the American Axle Company, capitalized at $6,000,000. had become heavily interested in the Beaver Motor Truck Company, of Hamilton, and in future would supervise the operation of the local factory, has been made. The American Axle Company operates axle and truck plants in a number of American cities and is rated as the largest exclusive manufacturer of worm drive axles in the world. The American company has become heavily interested in the Beaver Motor Truck Company and will supervise the operation of the local factory.

Under the scheme of reorganization, H. R. Williams, who organized the original Beaver Truck Company, becomes president and general manager, with E. W. Macavay, president of the American Axle Company as vice-president. Captain Harry Trenaman has been appointed treasurer, while William Mulvaney, E. D. J. Stares, W. H. Dawson, of the T. Eaton Co., P. C. Wolf and P. J. Schultz, of the American Axle Company, are the new directors. The reorganization of the local companay is expected to prepare the way for some big things. Plans are now under way to turn out 3,000 trucks during the next twelve months, while arrangements are being made to place a new model on the market.

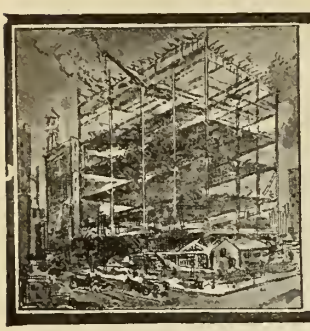
MORE CAPACITY FOR WIRE MILL

Steel of Canada Making Important Additions to Existing Plant

When the buildings now in the course of erection are completed, the capacity of the wire mill of the Steel Company of Canada at Hamilton will be doubled. The plans call for duplicating the capacity of the pickling room, annealing department, and also of the coppered wire department. The latter will then be capable of turning out 200 tons of finished wire per day, which will make it the largest wire mill in Canada. In addition to these extensions there is also being erected a large storage shed, steel construction throughout, equipped with travelling crane for handling raw material in the most economical manner.

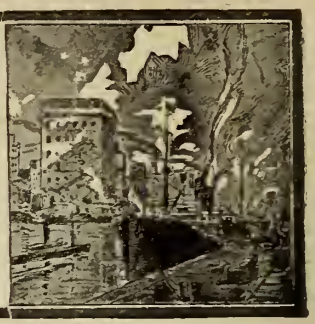


If interested tear out this page and place with letters to be answered.



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



TRADE GOSSIP

Equipment Wanted.—T. McAvity & Sons, Ltd., St. John, N.B., are in the market for a few No. 6 turret screw machines.

Locating in St. Thomas. — The Canadian Edison Phonographs, Ltd., have taken over the buildings in St. Thomas, formerly occupied by St. Thomas Cabinet, Ltd., and before that by Thomas Bros. The Edison Company took over the buildings, much of the equipment in the woodworking shops, and get six acres of land along with it. They have also placed orders for considerable new equipment in the line of woodworking machinery. The deal for the sale of the plant to the Edison Company was put through by Mr. William Garlock, of the Garlock-Walker Co., Toronto.

George A. Marshall, of Messrs. Marshall, Son & Bunney, 39 Richmond St. E., Toronto, has gone to England on the SS. Metagama, where he will spend a month or more on business matters.

Will Finish Ships.—Arrangements are being made by the Department of Marine with the liquidator of the Dominion Shipbuilding Co., of Toronto, for the completion of the two steamships which that corporation had under construction for the Government of Canada. The vessels, which were being built for the fleet being operated by the Canadian Government Mercantile Marine, are to be of 3,500 tons each, and about 75 per cent. of the work upon them had been done when the company went into liquidation. The Department of Marine will either undertake to do the remainder of the work or have it done through the liquidator.

May Earn Less.—In commenting on the business prospects, President T. J. Dillon, of Canada Foundries & Forgings, Welland, Ont., says: "In order to realize on the full possibilities of the plants this company found on its hands at the end of the war, it was considered advisable to appropriate a fairly large amount for additional equipment for rounding out their different units to lower the cost of manufacture of regular lines and add a few new ones. Indications point strongly to gradually lowering on steel commodities, and lessened dividends, which will result in declining earnings. Although the common dividend declared was somewhat less than those previous, it makes 10 per cent. for the year 1920."

J. F. MACKAY WITH MORROW COMPANY

Formerly Business Manager of Toronto Globe and Latterly With The Willys-Overland Co.

J. F. MacKay, formerly business manager of The Globe and latterly secretary and treasurer of the Willys-Overland, Ltd., has resigned his office with the latter company to become vice-president and general manager of the



J. F. MACKAY.

John Morrow Screw & Nut Co., Ltd., of Ingersoll. He will also occupy the position of vice-president of the allied industry, the Ingersoll File Co., Ltd.

This and other important changes are consequent upon the retirement of J. Anderson Coulter from the presidency of the two companies. Mr. Coulter has been actively connected with the progress of the industry for more than thirty years. The directors announce the election of Col. F. H. Deacon, of Toronto, as president; he has been vice-president of the companies. The other appointments are: Assistant general manager and treasurer, H. P. Stoneman; sales manager, F. N. Norton; secretary, Lt.-Col. H. L. Edmonds.

As to his successor in the important positions he has held with Willys-Overland, Ltd., no announcement has been made, but it is understood that the directors will ratify an appointment within the next week.

POWER CAUSES MORE TROUBLE

Industrial Centres Have Hard Time in Keeping Their Plants in Operation

BRANTFORD.—The Hydro Commission here has been unofficially notified that a 20% reduction in Brantford's Hydro allotment will be made shortly. A conference of manufacturers and the local Hydro Commission will be arranged to take steps to prepare for the cut. The situation here is already serious and the city council committee in charge of street lighting is prepared to curtail this to provide more power for domestic users.

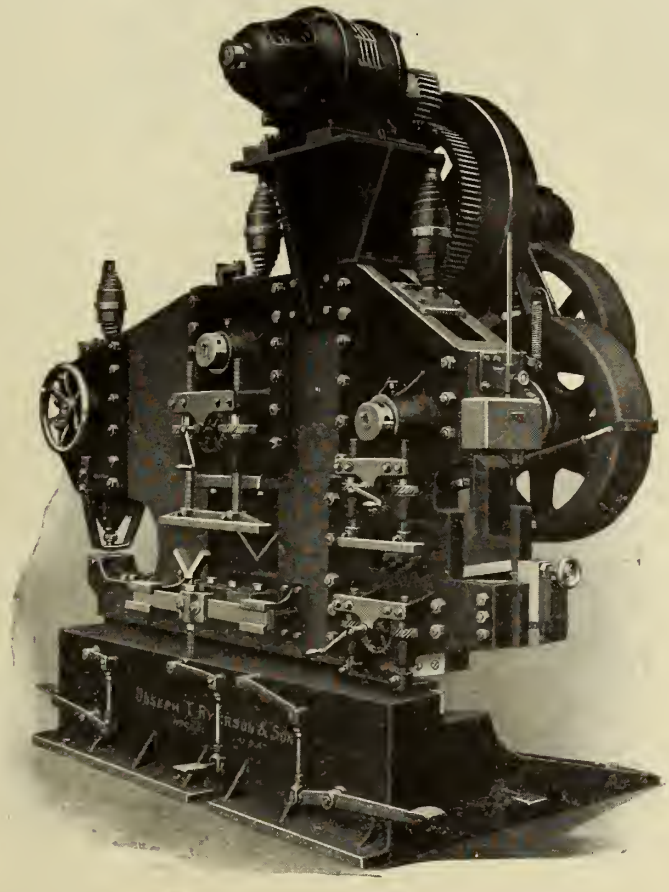
Windsor's Shortage

WINDSOR.—Deeming it necessary to bar use of Niagara power for signs and window lighting, the Windsor Hydro-Electric Commission will ask the city council to pass a by-law giving effect to a resolution passed at a meeting of the commission. O. M. Perry, manager of the local commission, said every effort will be made to discourage the use of electric heaters. Co-operation is necessary also on the part of business men, Manager Perry said, in order that street lighting may be provided in new residential sections.

New Incorporations. — Incorporation has been granted to the following: United Shoe Repair Shops, Ltd., Montreal, $50,000; Canadian Feature and Production Co., Ltd., Winnipeg, $1,000,000; The Bee Starch Co., Ltd., Montreal, $100,000; Canadian Harvester, Ltd., Toronto, $40,000; Canadian Skirmisher, Ltd., Toronto, $40,000; Canadian Rover, Ltd., Toronto, $40,000; Pacific-Atlantic Construction Co. Ltd., Vancouver, $5,000,000; The Davies Studios, Ltd., Montreal, $49,000; The Live Fish Co., Ltd., Quebec, $50,000; Cosmo Cotton Company, Ltd., Yarmouth, N.S., $600,000; Copeland Hotel Co., Ltd., Pembroke, Ont., $100,000; Sheffield Engineering Supplies, Ltd., Montreal, $50,000; Canadian Highlander Ltd., Toronto, $40,000; Canadian Libbey-Owens Sheet Glass Co., Ltd., Toronto, $1,680,000; Canadian Queen Manufacturing Co., Ltd., Vancouver, $100,000; Canadian Challenger, Ltd., Toronto, $40,000; Canadian Logger, Ltd., Toronto, $40,000; Commercial Investigators, Ltd., Montreal, $50,000.

Steel Frame Quintuple Combination Punching and Shearing Machines

In Stock for Immediate Shipment



The Ryerson Steel Frame Quintuple Combination Punching and Shearing Machines embody five metal-working machines in one unit. These machines will handle the shearing of plates, round and square bars, coping and notching, section cutting and punching, without changing any tools or attachments.

We are manufacturing these machines in six sizes, with various capacities, covering a range of work from that of the ornamental iron and light structural shop to that of the heavy bridge-building plant.

Write for Complete Descriptive Bulletin

JOSEPH T. RYERSON & SON

CHICAGO, ILL., U.S.A.

MACHINERY

Canadian Representatives:

GARLOCK-WALKER MACHINERY CO., 32-34 Front Street West, TORONTO

MONTREAL WINNIPEG

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The Week's Events in Montreal Industry

H. B. Smith, formerly president of the Northern Navigation Company, has been appointed managing director of shipyards for the Canada Steamship Lines.

Thos. Robb, secretary of the Shipping Federation, has sailed for Europe, where he will represent Canadian shipping interests at the meeting of the League of Nations to be held shortly at Geneva.

D. M. Brown, formerly office manager of the Montreal branch of the Holden Company, has been appointed manager of the Ontario division, with headquarters at Toronto. C. M. Gray will succeed Mr. Brown as office manager at Montreal.

The Montreal Chambre de Commerce has been considering the advantages that would follow the building of a tunnel under the Champ de Mars and Jacques Cartier Square, for the purpose of relieving the congestion that frequently occurs in this vicinity on market days and when traffic to and from the harbor front is excessive. No definite action has been taken but the project has been laid before the Administrative Commission.

At a recent meeting of the Montreal Branch of the Engineering Institute of Canada the entire evening was devoted to moving pictures, both of an instructive and entertaining character. One of the reels shown was in connection with the work of McGill University. Every branch of the work was covered by the film, including educational, athletic and military features. Between the showing of the pictures brief addresses were given by J. L. Busfield and the secretary, F. S. Keith.

Following a conference held between the Administrative Commission and an influential delegation of business men and citizens of Montreal, headed by Lord Shaughnessy, a deputation will go to Ottawa to confer with the Government on the question of constructing a second bridge across the St. Lawrence in the vicinity of the harbor of Montreal, to connect the Island with the south shore. It is felt by a large number that this additional means of communication between the two points is an urgent necessity and that the next few years will demand some relief from the present conditions.

At a recent meeting of the Montreal branch of the Rotary Club, F. E. Rejall gave an interesting address on high-speed steel, touching on the electric and crucible processes of manufacture. While intimating that considerable progress had been made with the electric furnace in this connection, he favored the crucible method, as the product thus obtained was more homogeneous and much better quality although much more expensive to manufacture than the other, owing to the ability of the electric furnace to take a charge of six tons and over, while an average crucible would contain from 60 to 80 lbs.

On Saturday last the Canadian Vickers Company successfully launched the Canadian Commander, the eleventh vessel constructed by this company for the Canadian Government Merchant Marine. The ceremony of christening was performed by Mrs. Ballantyne, wife of the Minister of Marine and Fisheries. This new addition to the National fleet is a steel vessel of 8,350 deadweight tons, 413 feet long, 53 feet beam, and 31 feet deep. The vessel was built under the supervision of C. F. M. Duguid, of the Department of Marine, and W. J. Alderson, representing Lloyd's Register of Shipping. The boat is equipped with triple expansion engines and Scotch boilers fitted with Howden's forced draft system.

The Montreal Board of Trade at a recent meeting had before it a communication from the Jamaican Boards of Trade in which those bodies had passed resolutions endorsing the movement to increase trade relations between Canada and the British West Indies. The letter pointed out a number of impediments to trade which would require adjustment before further action would be taken. The chief obstacle is the present so-called "16 Dutch" standard and color test on Jamaican sugar coming into Canada. The West Indies Boards of Trade are also in favor of a mutual preferential tariff, which, they claim, would not only cement present friendly relations but contribute to a large degree in the extension of trade between the two countries.

The Canadian Vickers Company of Montreal has recently received word from the aviation branch of Vickers Limited of England that the parent company has been awarded first prize of £10,000 as the winner of the amphibian class of aeroplanes. The "Viking" machine was designed by Mr. R. K. Pearson, who also designed the famous and successful "Vickers Vimy." The Viking is fitted with a 450 h.p. Napier engine, is capable of carrying five passengers at a speed of 120 miles per hour, and can be landed on water and driven ashore without any special slipway. It is worthy of note that this is the fourth big prize won by Vickers machines in air or air and water competitions. These include the prize of £10,000 won by the late Sir John Alcock in his flight across the Atlantic, and a like prize won by Sir Ross Smith in his London to Australia flight. It might be well to mention that extensive experimental work has been constantly carried on by the Vickers Company since the armistice in the development of air machines and that the expenditure in this connection far exceeds the amount of the prize just awarded.

BUSINESS PAPER EDITORS' MEETING

Interesting Sessions in New York Followed by Election of Officers

Clay C. Cooper, Mill Supplies, Chicago, was elected president of the National Conference of Business Paper Editors for the ensuing year at a meeting held in connection with the annual deliberations of the Associated Business Papers, Inc., at the Hotel Astor, New York City, Oct. 20 and 21. The other officers chosen were: Vice-president, C. J. Stark, The Iron Trade Review, Cleveland; secretary-treasurer, R. Dawson Hall, Coal Age, New York. The executive committee is composed of A. I. Findley, Iron Age, New York; C. T. Hawson, Railway Maintenance Engineer, Chicago; A. R. Kennedy, Canadian Machinery, Toronto; James H. Stone, Shoe Retailer, Boston; H. L. Parmalee, Metallurgical and Chemical Engineering, New York; and Arthur L. Rice, Power Plant Engineering, Chicago.

FIRMS LOOKING FOR CONNECTIONS

MAY BE SOME ITEMS HERE YOUR FIRM CAN SUPPLY THEM WITH

By communicating with this paper and mentioning key numbers, information can be obtained by firms interested in the following lines:

2118. Tree-Felling Machinery. — A London company have an enquiry for tree-felling machines and would be glad to hear from Canadian manufacturers with catalogues.

2119. Hardware, etc.—A commission agent in Barbados, in good standing and representing a number of English firms, is desirous of obtaining a Canadian connection for general hardware, including such lines as valves, stop-cocks, etc., for machinery, also nails, locks, etc.

2229. Iron and Iron Products.—A firm in Jassy, Roumania, is desirous to receive quotations c.i.f. Roumanian port as well as other particulars from Canadian firms in a position to export iron and iron products, tools, utensils, stoves, etc.

2230. Steel Baling Wire.—An Ormskirk firm asks to be placed in touch with exporters of Canadian grain and steel baling wire used for pressing hay and straw by steam.

When we work hard with our body all day our backs ache and our muscles ache. This is all right, for nature has given us sweet, refreshing slumber to drive away the aches and pains so that on the morrow we are ready for the fray.

It's better to wear out than to rust out.

MORROW



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No Reliable Jobber will Substitute

FORGED drills are built on scientific principles with a view to MAXIMUM PRODUCTION. They are made from hammered bars of high speed steel (not less than 18% tungsten content).

The drills are forged at plant No. 3 and are hot TWISTED (the grain of the steel runs with the twist). They withstand the torsional strain under most exacting duty and give more holes with less re-grinding.

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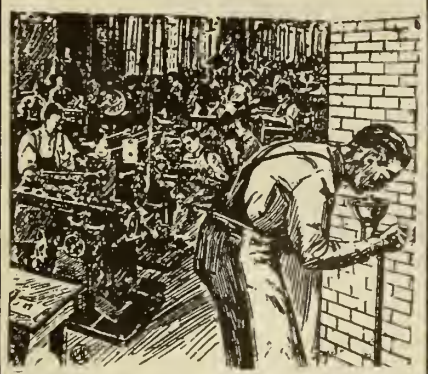
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Set and Cap Screws, Engine Studs, Nuts, Files and Rasps.

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of your employees
depend your profit
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Throw out the germ-laden Drinking Cup!

Give your men a clean drink

PURO SANITARY DRINKING FOUNTAIN

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Allows just the proper amount of cool, clean fresh water to come through the bubbler. No spurting, overflowing, no loss. "Puro" regulates itself. "Puro" saves 35% on water bills, too. You can attach it in a few minutes. Tell us how many men, how many departments and we'll tell you how much the cost will be.

Puro Sanitary Drinking Fountain Co.

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Machine Springs, Valve Springs, Automobile Cushion Springs, etc., of a quality that defies competition. Tell us your requirements. Send sample or specification for price.

JAMES STEELE, LIMITED

GUELPH, ONTARIO

PORTABLE BOATS OF EARLY RAILROAD PRACTICE

(Continued from page 417)

Gay notes that the number of engines in service had increased to 17, ten of which were manufactured by M. W. Baldwin; five by Robert Stephenson, of England; one by Coleman Sellers & Sons; and one by Long & Norris. Commenting upon the engines, he says:

"The two latter have been but recently put upon the road, and their capacities are not yet fully tested; they are, however, believed to be excellent engines. The engines from Mr. Baldwin have all been tested and found to be of the first class. The five engines imported from England are not as efficient as those manufactured in this country; the workmanship of them is good, but many important parts of the machines are too light to enable them to encounter (with a heavy load) the high grades and severe curves on this railway, in consequence of which frequent repairs are required upon them."

(To be continued)

FACTS REGARDING THE OXY-ACETYLINE PROCESS

(Continued from page 422)

repair was comparatively low. This casting was broken through the middle and by looking closely the welded section may be seen.

Fig. 2 illustrates a gas engine cylinder weighing 1,500 lbs. that got cracked by frost. Again the outlay to replace would have been considerable, and the cost an item to be seriously considered, but welding proved the solution. In 48 hours the engine was dismantled, the bed welded and the engine re-erected ready for service again.

Consider the case of Fig. 3. This was a nail machine bed that broke through the middle and looked like a serious matter for a while. In 48 hours, however, the machine was again fit for service and the repair made at very little cost.

The next example, Fig. 4, depicts the face plate of a large wheel lathe, which was used for machining locomotive drive wheels. It became broken by accident and represented a loss of some hundreds

Machine Tool Builder Knew the Facts and Was Able to Help Out

AN automobile maker—and this was in the Canadian field—after the lowered prices had been announced on cars, called on a number of the firms with which he was doing business into conference and explained that it was desirable from his point to have lowered prices on the things it was necessary to buy in order to make cars at the new prices.

These meetings lasted for several days, and very little progress was made. Most of those called in had no intention of altering their prices. One maker of machine tools had the facts presented to him. He knew all about the business that the firm had, and he also knew much of the design of the machines that were being made.

When the proposition was put up to this firm to improve in the matter of price their representative was ready with a real suggestion, based on a knowledge of the construction and design of the special machines that the automobile shop was securing from his factory.

His proposition was soon stated: "Yes, we can change the price of the machine if you agree to alter the design in such a way that it will allow us to give you a machine that will serve your purpose just as well at a lower figure."

This was a new one to the automobile man, and he had not been looking for such a thing. He at once called in his designers and a draftsman, and together with the representative of the tool builder they went over the machines that were on order. The machine tool man went right to the point at once and showed them where they were calling for dimensions that were so fine in some ways as to be very expensive in obtaining, and also convinced them that there was no necessity for this for the class of work required. He went carefully over the blue prints and drew attention to other details that were not necessary, but which had been insisted on by the automobile factory. The elimination of these and the general simplifying of the design would make it possible to reduce the price of the machine by a very fair margin, and as there were a number of these machines on order the total saving would amount to quite a respectable figure. It was also shown that the automobile factory would have a machine that would do the work required just as well as previously.

The result was that the business stayed on the books of the machine tool maker. The automobile firm was pleased, and their work will be done just as well as previously. The machine tool builder will get just as much profit as formerly.

And don't you suppose that the automobile man will be inclined to go back to that same firm of builders next time he wants to get some real service and some real help in order to assist him in meeting a new situation?

of dollars. Four hours was all that was necessary to have it again equal to new.

When a large flywheel of the size shown at Fig. 5 and weighing 3,500 lbs. is incapacitated from service, a serious loss must inevitably follow unless it is possible to repair it again quickly. This was done by oxy-acetylene welding as before, and the saving in time and money effected may be easily imagined and further comment is hardly necessary.

The next two illustrations, Figs. 6 and 7, show a Hart-Parry gasoline engine cylinder that weighed 325 lbs. It has a ten-inch bore. The views show it before and after welding, and the work in its entirety only took about three hours.

The remaining two illustrations, Figs. 8 and 9, depict an automobile cylinder before and after welding. For reclaiming such parts this process is ideal, and has saved many a dollar. There are, of course, hundreds, yes, thousands, of cases that could be quoted and illustrated showing how this system has proved of decided value, but enough has been illustrated to start the ball of thought arolling. We appreciate the courtesy of L'Air Liquide Society, who very kindly loaned us these illustrations, as examples of work performed. Oxy-acetylene welding is only in its infancy, and the chief thing to do is to have confidence in it, then follow up that confidence by actual use.

The Seneca Falls Mfg. Co., Inc., have recently acquired the business of the O. R. Adams Manufacturing Company, Inc., of Rochester, N.Y., which was organized about two years ago to develop and manufacture a new type of production lathe called the "Adams Short Cut." It is a compact, sturdy, geared head machine, capable of taking a cut said to be equal to the average 16-inch engine lathe, occupying less than one-half the floor space with a corresponding reduction in investment.

The Seneca Falls Manufacturing Company, Inc., are planning to consolidate the business of both companies at Seneca Falls, N.Y., where additional facilities will be provided to increase the manufacture of both the "Star" and the "Short Cut" lathes.

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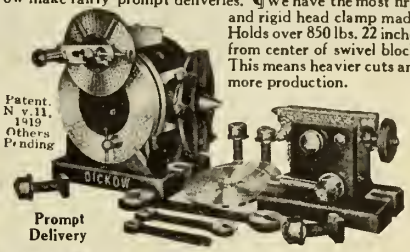
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MANUFACTURERS REQUIRING MACHINERY can with advantage obtain speedy delivery, through our Surplus Plant and Machinery Dept., constituted some years ago for the handling of Surplus Plant, of Boiler Works, Ship Yards, Engineering Works, etc. New or Good Used Plant as required. Please send enquiries. Pillatt & Co., Ltd., Stapleford Iron Works, Nr. Nottingham, England.


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WANTED IMMEDIATELY—1 30-TON LUCAS Forcing Press. Address all replies to Box 722A. Canadian Machinery.

WANTED FIVE TO SIX HUNDRED H.P. CORliss engine, also 72 in. roller-band resaw; 250 tons 40 or 50 ft. rails; 5-ton locomotive crane; all must be in good shape. Apply N. J. McArthur, 325 Howe St., Vancouver, B.C. (cfm)

WANTED—6 IN. HORIZONTAL, 54 IN. AND 66 in. upright band resaws; steam engines, 35 to 125 h.p.; 36 in. gang saw grinder, planers, edgers and sprocket chain, etc. R. C. Patterson, Smithville, Ont. (cfm)

WANTED—ONE VAN NORMAN USED DUplex milling machine; one 36x36x10 ft. used metal planer; 36 or 30 used 2 or 3 drum sander, Berliner or similar machine; 14 or 16 in. used hand jointer; 12 in. wood lathe, used; 14 or 16 in. double end wood lathe, used; 18 in. pattern makers' disc grinder, double end, used. Box 725F, Canadian Machinery.

WANTED—A FEW NO. 6 TURRET SCREW machines. Box 726F, Canadian Machinery.

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WANTED—BY A PRACTICAL FOUNDRYMAN with good technical training, position as foundry foreman. Can mix by analysis to suit all grades of castings and cannot be beaten on cupola practice. Am familiar with all modern foundry appliances and molding machines. McLain graduate. Reply Box 724, Canadian Machinery. (c20m)

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WANTED—Circuit breakers, 2-3 phase, 2200 volt, 100 amp., oil switches for pipe mountings with overload release. 1-2 phase same as preceding. Frid Construction Co., Limited, Hamilton, Ont. (cfm)

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LATHES—**Special price quoted on rebuilt 20" x 8' C.M.C. Lathes.**
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Condition equal to new.
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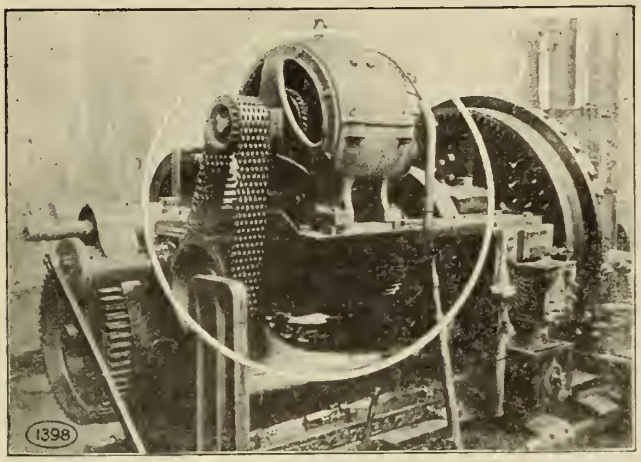
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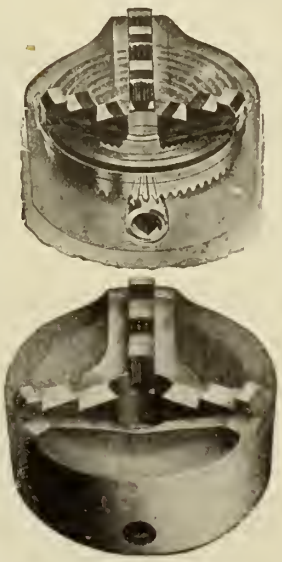
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Until sometime after the war we were unable to secure these chucks, but can now fill all requirements of the trade.



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That day has passed. The advertiser no longer depends upon "mere claims." The Audit Bureau of Circulations has untied the strings to the sack and the circulation of the better class of publications is thrown open for the most searching scrutiny.

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Reduces Floor to Floor Time In the Machining of Short Parts

Swings 13⅝", takes between centers 20".

Choosing equipment adapted to the job means economical production. The SHORT-CUT LATHE is designed to handle the kind of pieces which predominate in most shops.

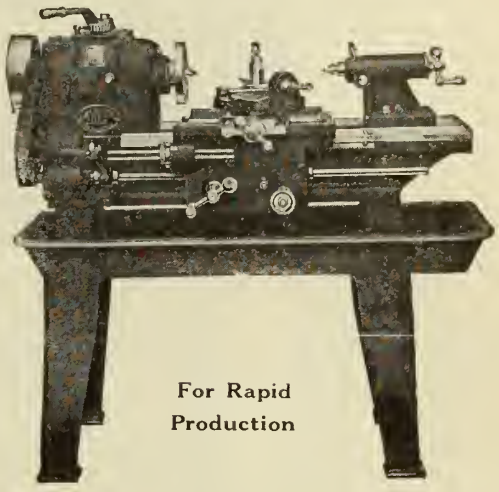
The lathe has enormous power, is simple, compact and convenient.

Will replace lathes of much greater swing.

Occupies floor space 4' 6" x 2' 4".

Estimates on production with cost of tooling submitted on receipt of sketches or samples of work. Write for descriptive circulars.

We also manufacture "Star" Engine Lathes.



For Rapid Production

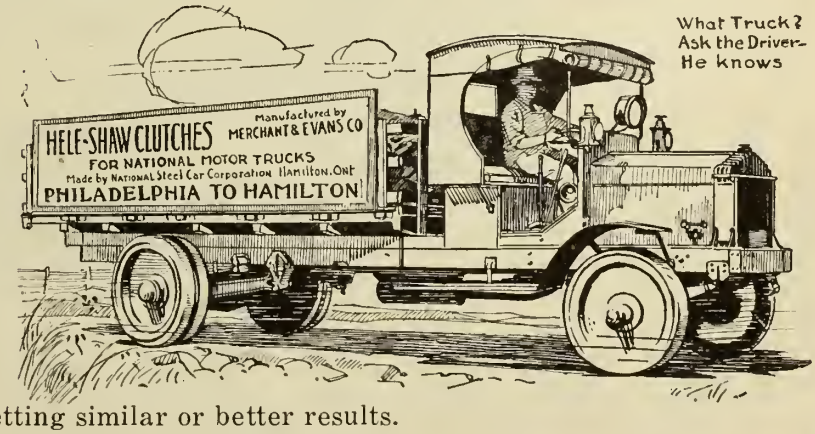
The Seneca Falls Mfg. Co., Inc.
366 Falls St., Seneca Falls, N.Y.

The Heart Of The NATIONAL

Pulses With Power

Mighty power efficiently controlled resides in these massive servants of industry; making the world's work easier, setting new goals of achievement, bridging a thousand gaps in the smooth evolution of industrial and commercial life.

Take the National Economy Record for instance, set by a National Truck. 1,410 miles at 28 cents a mile. Hauling a load at 16 cents per ton per mile. This trip, from Hamilton to Philadelphia and return, was made by a four-year-old, 3½-ton National, during a recent rail tie-up when parts were urgently needed at our plant.



National owners everywhere are getting similar or better results.

A National taps sources of supply quickly and directly. It opens new fields of demand. It is a strong offensive against competition.

There is a National to suit your needs—1, 1½, 2, 3½ and 5 tons.

National Steel Car Corporation Limited
HAMILTON, CANADA

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100% MEMBERSHIP

On Wednesday, Oct. 20, the Association of Canadian Advertisers endorsed the statement of W. G. Stewart of Goodyear Tire and Rubber Company that all trade newspapers should be required to furnish audited statement of circulation.

We're with you, Mr. Stewart. Every publication issued by MacLean Publishing Company is a member of Audit Bureau of Circulations.

Advertisers who are members of A. C. A. and those who are not would be acting in their own interests and in the interests of Canadian publishers by insisting that every publication in which their advertisements appear should come out into the open and furnish a statement of circulation certified by some independent organization such as A. B. C.

The following MacLean publications will gladly send A. B. C. statement of circulation on request:

TRADE NEWSPAPERS

HARDWARE AND METAL
DRUGGISTS' WEEKLY
CANADIAN GROCER
SANITARY ENGINEER
DRY GOODS REVIEW
MEN'S WEAR REVIEW
BOOKSELLER AND STATIONER
CANADIAN MOTOR, TRACTOR AND IMPLEMENT TRADE JOURNAL

MAGAZINES

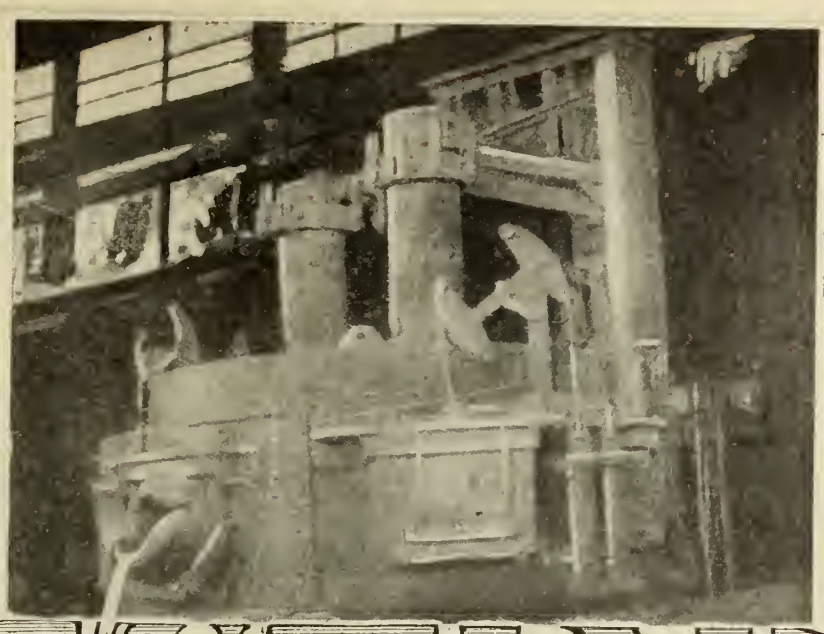
MACLEAN'S MAGAZINE
FARMERS' MAGAZINE

TECHNICAL NEWSPAPERS

POWER HOUSE
CANADIAN MACHINERY
CANADIAN FOUNDRYMAN
MARINE ENGINEERING
PRINTER AND PUBLISHER

COMMERCIAL NEWSPAPER

THE FINANCIAL POST



ELECTRITE

High Speed Steel

SEVERAL factors combine to make this high-speed steel a triumph of the steel-maker's art; Electric Furnaces—entirely infallible, automatically regulated, delivering the same result time after time.

Uranium — This rare element, cousin to Radium, effects a profound change in the texture and quality of the steel.

Added to these, the constant care and skill of years of steel-making experience make the result of each melt a foregone conclusion.

Latrobe Electric Steel Co.

LATROBE, PENN.

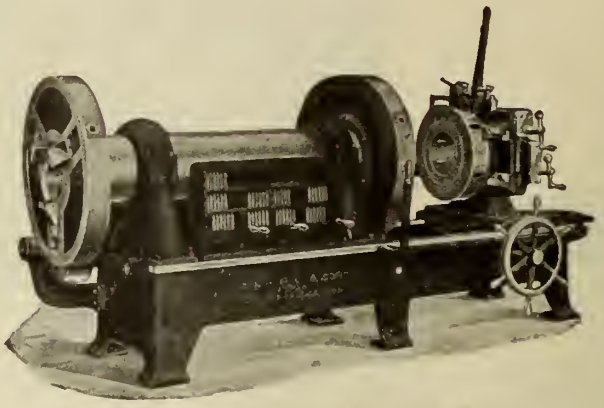
URANIUM

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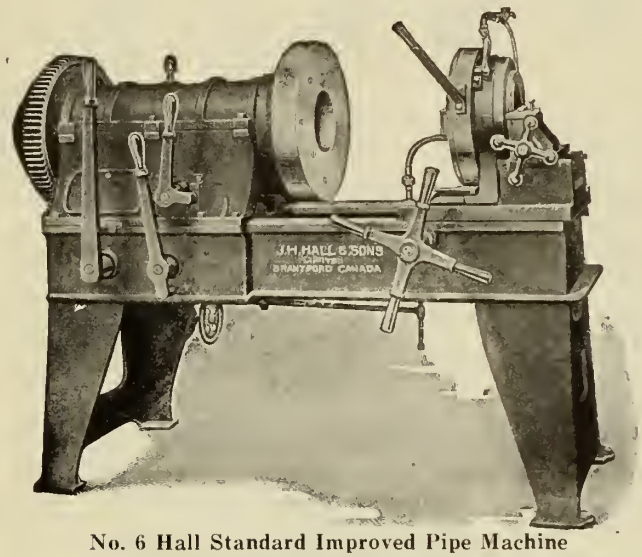
Hall Pipe Machines

Increase Your Output At Reduced Cost

IN Hall Improved Pipe Threading Machines are embodied several extensive, and distinctly Hall, improvements which will greatly reduce operating costs and give far greater output.



No. 8 Hall Duplex Improved Pipe Machine



No. 6 Hall Standard Improved Pipe Machine

15 Distinctive Hall Features

1 Single Pulley Drive, through.
2 Dodge Friction Clutch, on machine.
3 Clutch Lever at operator's left hand.
4 Rigid Bearing Bracket on drive shaft.
5 Gear Box Drive away from operator.
6 Individual Adjustment for each bearing.
7 Large Spindle Bearings are ring oiling.
8 Compact Control Levers on operator's side.
9 Large Die Cabinet and Tool Tray.
10 Substantial Oil Trough around top of ways.
11 Specially constructed Reservoir and Filterer.
12 Low-down Sliding Head.
13 Rotary Geared Pump reversible for left-hand thread.
14 Specially designed Carriage to drain off oil and cuttings.
15 All Gears amply protected.

Hall machines are designed to allow the utmost freedom and ease to the operator. The front and operating side of the machine is left perfectly free and the machine is under complete control from the operating side at all times. The time-saving value of this is obvious.

Fuller particulars of the advantages of Hall Pipe Machines will gladly be furnished upon request.

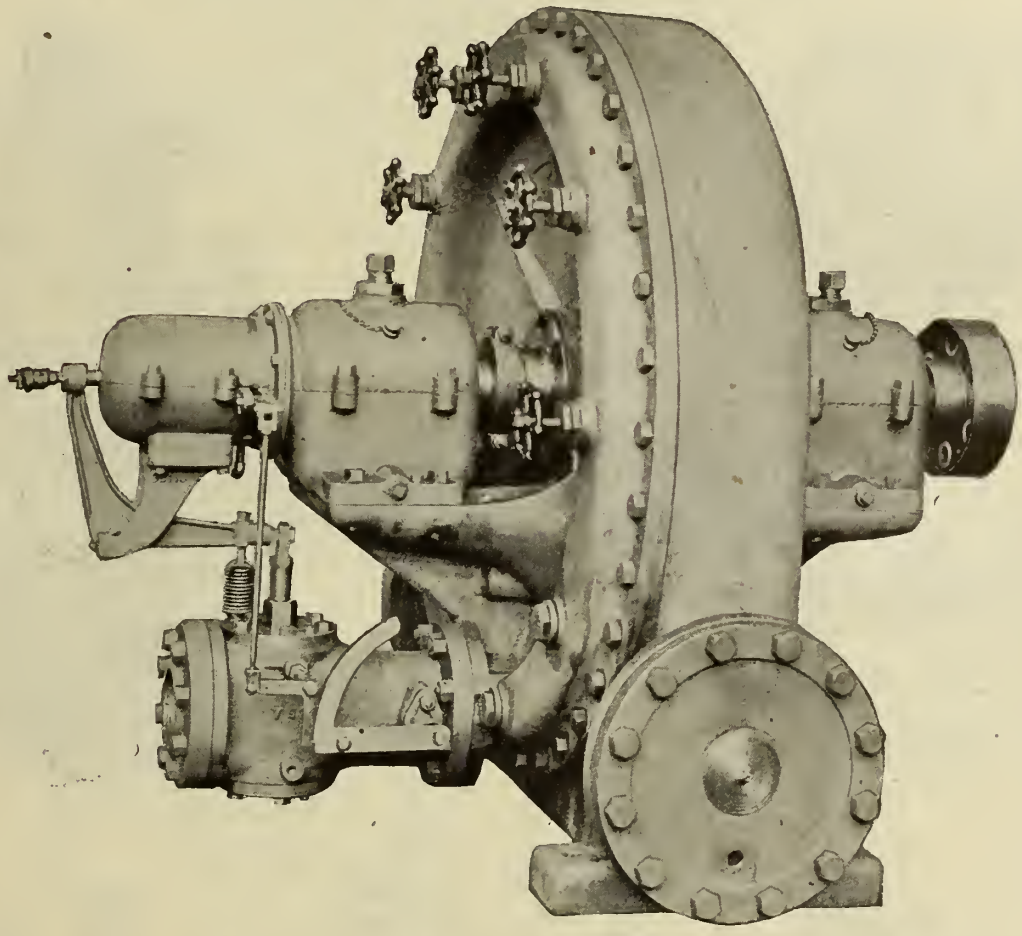
Williams Tool Corp. of Canada, Ltd.

Brantford, Canada

Successors to John H. Hall & Sons, Limited

Sturtevant
(TRADE MARK)

TYPE 6 STEAM TURBINE



For Driving Fans, Blowers, Centrifugal Pumps and Generating Sets—

Sturtevant Type 6 Steam Turbine retains all the fundamentals of previous types and in addition embodies many refinements in detail construction.

This Turbine is particularly adapted for direct connection to blowers, fans, electric generators, and centrifugal pumps.

It uses less steam in the long run than the steam engine, with minimum amount of attention. The simplicity of its construction makes it absolutely reliable and minimizes the loss due to shut-downs for repairs.

When used with other Sturtevant apparatus it gives the purchaser a complete unit backed up by the Sturtevant guarantee.

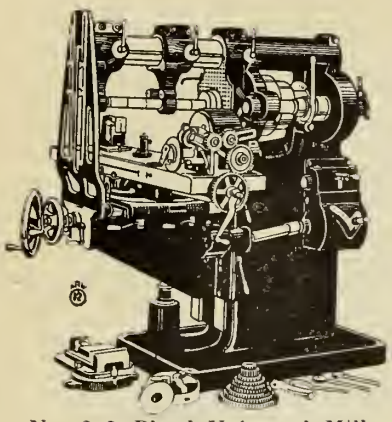
Catalog No. 256-H covers the construction and uses of Type 6 Turbine in detail. Let us send you a copy.

B. F. STURTEVANT CO. OF CANADA, LTD.

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SALES OFFICES: TORONTO AND MONTREAL

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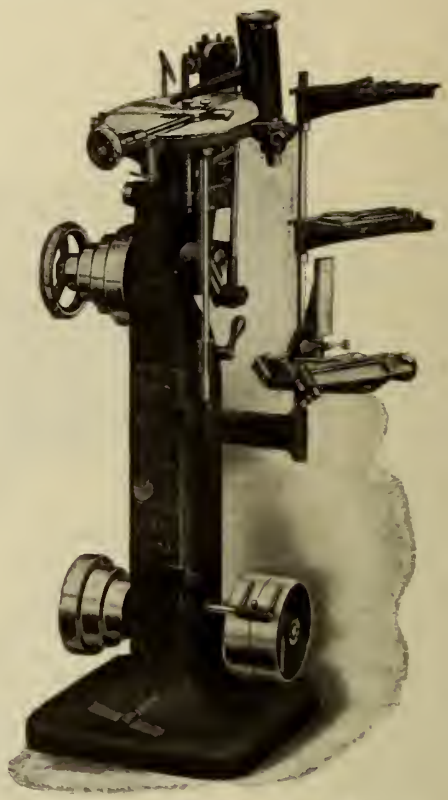
MACHINE TOOLS
NEW AND REBUILT



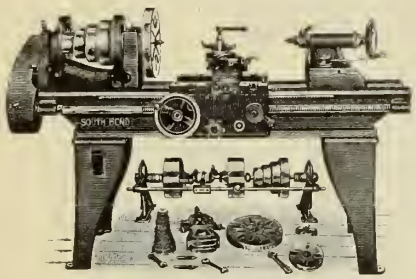
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All kinds and sizes.

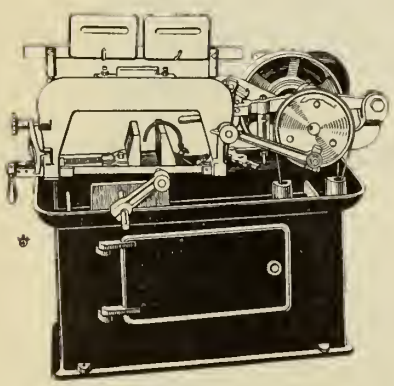
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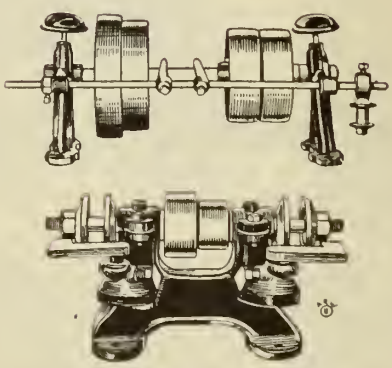
Cochrane-Bly Vertical Filing Machine



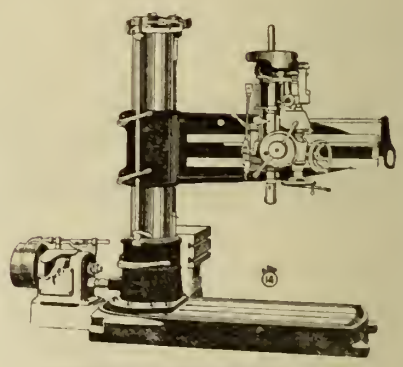
South Bend Lathe



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Electric and Oxy-Acetylene
WELDED TUBING
Also BUTT SEAM TUBING

We have a thoroughly equipped plant for Welding by Electric and Oxy-Acetylene processes. Oxy-Acetylene Welded Tubing is recommended for bending purposes; Electric for straight, or slight bends. Butt Seam Tubing is also one of our specialties. Tubing made hot or cold rolled finish.

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Let us advise you of the kind of tubing that will best suit your requirements. Inquiries gladly answered.

The Tube Company of Canada LIMITED

233 Dufferin Street, TORONTO, Canada

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Take packings—rod and sheet—away from the industries, and even the most inexperienced knows what would happen.

With the operation of practically all kinds of plants, factories, mills, etc., so utterly dependent on rod and sheet packings to allow proper operation, why use any but thoroughly reliable and well-known products?

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Probably the best known rod packing on the market. Unequalled for the packing against steam, water, air, ammonia, and other fluids.

Many practical tests by experienced engineers under various conditions have clearly demonstrated that P.P.P. is the most economical rod packing to use. Its long life is remarkable, its ability to create a saving in the fuel bill is well known.

"The Story of Some Friction Test"

is a booklet that should be in the hands of everyone who has anything to do with rod packing, whether buyer or user.

EBONITE SHEET PACKING

Used exclusively in many of the largest power houses, factories, and machine shops, for high pressures, super-heated steam, hot water, ammonia, oils and acids and all other kinds of joints requiring packing.

EBONITE will hold a vibrating joint absolutely tight, and where there is a varying expansion or contraction of the pipes EBONITE is especially desirable.



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Armstrong Planer Tool

Patented

Costs less than a High Speed Forged Tool. Effectively it equals a dozen.

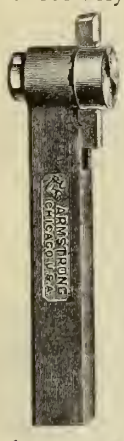


Fig. 1 shows the Armstrong Planer Tool cutting a keyway with the cutter reversed and the tool turned around, thus throwing the cutting point behind center of tool and working as a "goose neck" tool.

Fig. 2 shows Armstrong Planer Tool at work in close corners, giving a good general idea of clearance obtained. It shows also a few of the angles at which the cutter can be set. A job similar to one shown could be finished with the Armstrong Planer Tool without shifting position of the work on bed.



Fig. 1



Fig. 2

Armstrong Gang Planer Tool

Patented

For Planing Large Surfaces





As each chip is comparatively light, a planer will, with this tool, carry with ease a feed and depth of cut much greater than is possible when using an ordinary tool, and there is much less tendency to "break out" at the end of the cut.



NEW CATALOGUE B-20 FREE

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High-class Drills with IRRESISTIBLE PIERCING FUNCTIONS that stand the WEAR and TEAR—in other words, the DRILLS that are EFFICIENT and ECONOMICAL—are the DRILLS with the "DORMER" Brand.

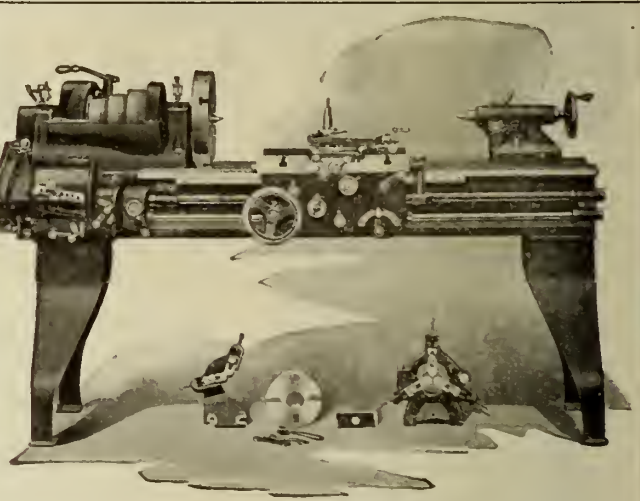
We are manufacturing SPECIALISTS—Carry large STOCKS—Give PROMPT deliveries, and rely upon our products for REPEATS.

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MONTREAL CANADA



Extreme Precision

The "Economy" 14-inch Swing Double Back Geared Quick Change Engine Lathe, though small in size, is of sufficient weight and power to handle the rapid production of the modern manufacturing plant. Its high grade and extreme accuracy make it particularly adapted to the tool room. Made in 14", 18" and 22" swing.

Have us send you full particulars of this small, heavy duty machine without delay.

Rockford Lathe and Drill Co.

Rockford, Illinois, U.S.A.

Buried in the Work and Broke!



Next time a tap breaks below the surface of a large casting, don't let some makeshift method of removing it injure the thread and waste half an hour of valuable production time. Instead—



Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

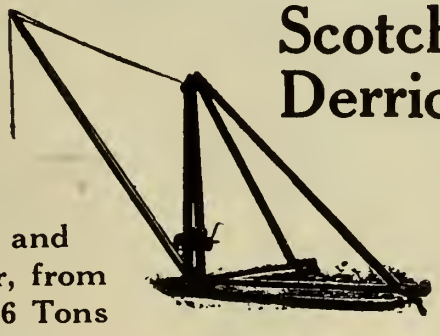
Sixty-day trial offer proves the Walton Extractor pays for itself.

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The Walton Co.
Hartford - - Conn.

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The Hepburn Scotch Derrick is a simple piece of equipment which will prove of immense value as a time and labor saver in the handling of heavy materials.

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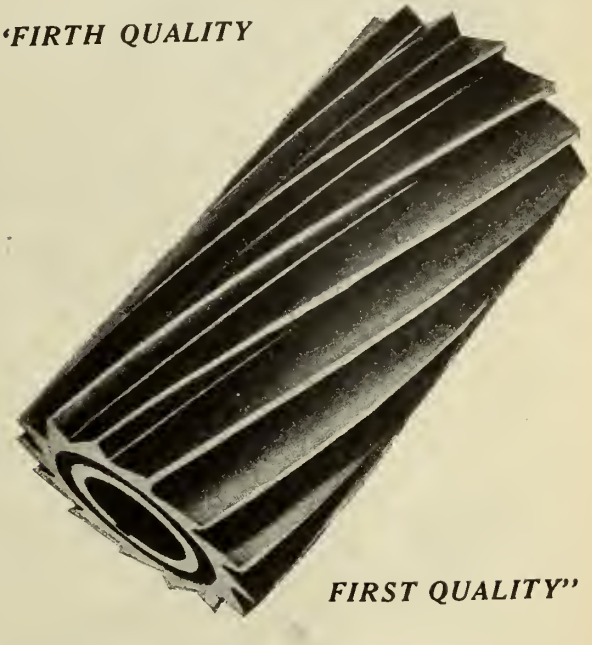
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HIGH SPEED STEEL

is the product of Sheffield's Modern Steel Mill. Made of selected materials by steel makers skilled in their craft. A unique and superior steel among high speed steels.

"FIRTH QUALITY



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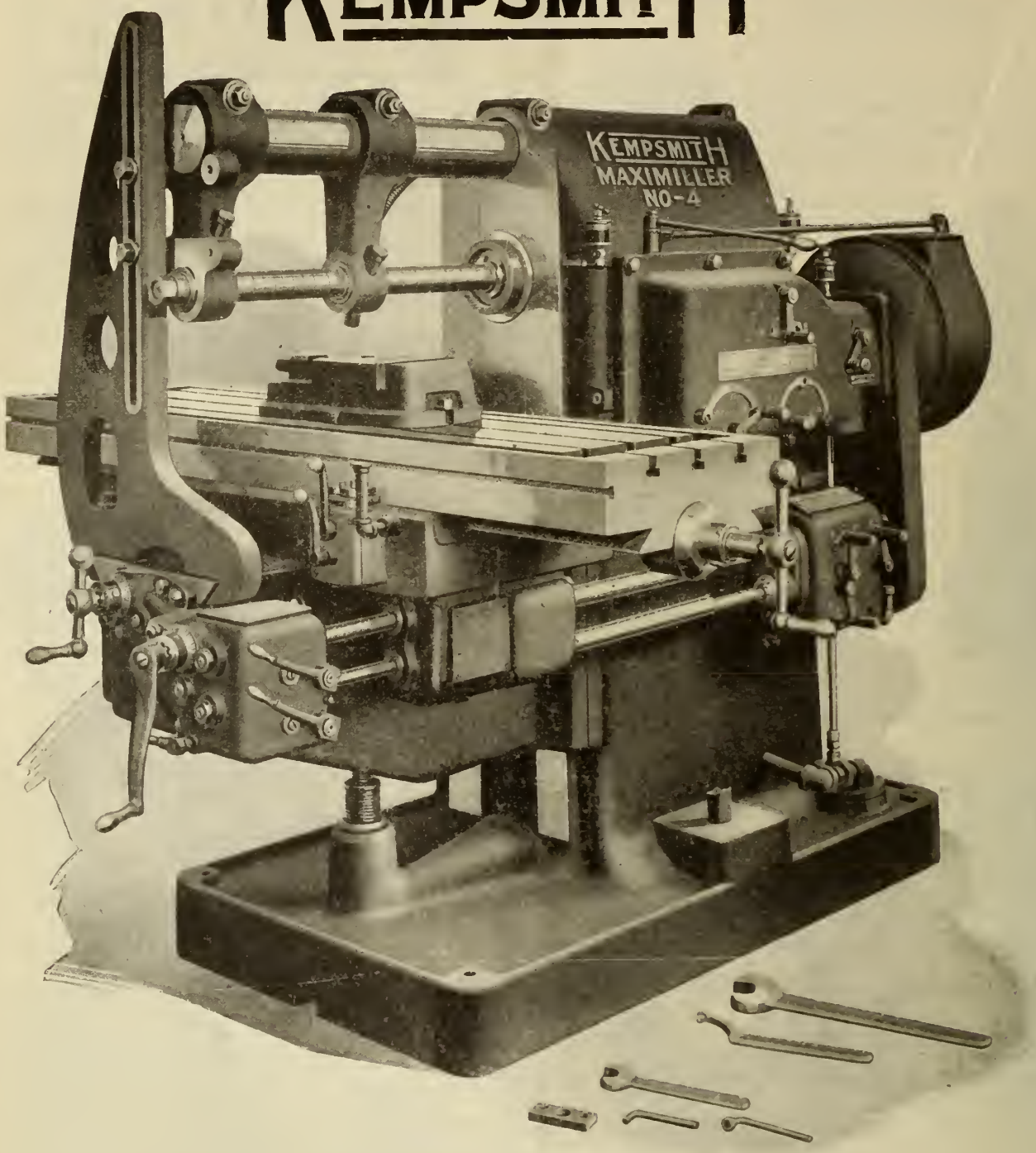
SPEEDICUT is unexcelled for the manufacture of Drills, Taps, Reamers, Milling Cutters, Threading Dies, Forming Tools, etc. As well as Lathe Slotter, Planer, Shaper, Boring Mill and all Machine Shop Tools.

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A veritable maximum in milling machines embracing all Kempsmith patented features, permitting a maximum in production and efficiency. Write for particulars as to this machine.

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STARRETT HACK SAWS CUT QUICKER LAST LONGER

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Starrett Tools



SAVAGE



.250-3000 Savage Rifle, take down model, 22-inch tapered round barrel with integral sight base. Checked extra full pistol grip and forearm, checked trigger. Corrugated steel shotgun buttplate. Commercial silver bead front and flat-topped windgauge sporting rear sights. Weight about 7 lbs

Charles Cottar's Score with the .250-3000 Savage on Lion — 100%

Do you know how many hunters are killed or mauled by lions every year? Do you realize that the lion is the African travellers' and hunters' greatest peril?

Listen to what Mr Cottar says about what the little .250-3000 Savage does to the king of beasts —

"On lions and leopards—I have shot a score of the two species with the .250, and some of them at less than a rod distance—not one escaped that was hit"

The power of the 250-3000 Savage makes lions as easy as leopards to the man who has used it on both. And he has killed rhino, hippo, buffalo and elephant with it. Do you wonder that he finds it the most generally useful rifle for African hunting?

And don't forget that it's a six-shot repeater that weighs only seven pounds—that it has a point-blank range of over 300 yards—that it is accurate enough to make possibles at 800 yards—and that it hardly kicks at all.

You can see it—handle it—buy it—at your dealers. For particulars, write us.

SAVAGE ARMS CORPORATION

Sharon, Pa. UTICA, N. Y. Detroit, Mich.

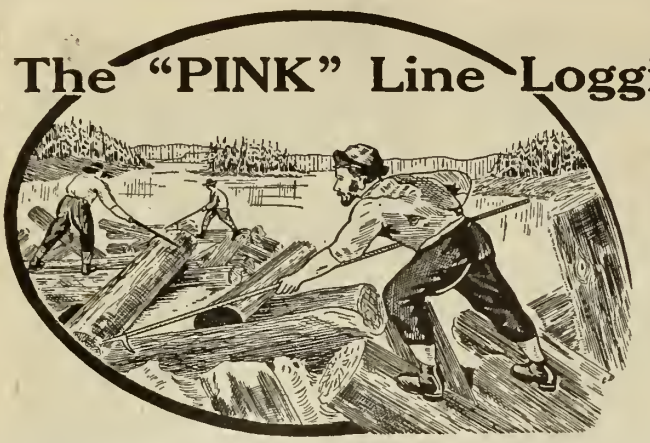
Executive and Export Offices: 50 Church Street, New York City

Starrett Tools

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MADE-IN-CANADA Products---Headquarters for British Empire for all Lumbering Tools

In every lumber camp in Canada you'll find PINK'S famous lumbering tools. They are the favorites there and have won the esteem of all woodsmen through their superior merit. They are world-renowned and are extensively used in Australia, New Zealand and other countries where the lumbering industry thrives.

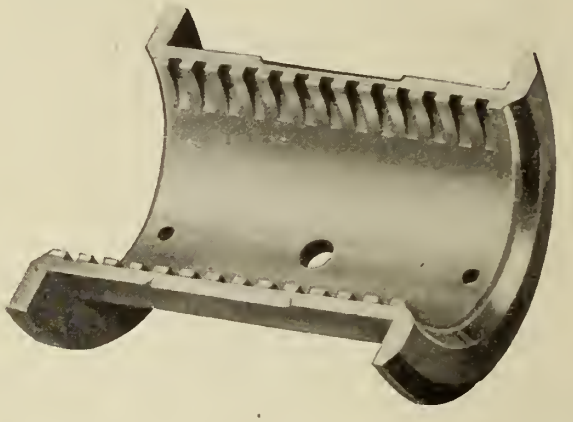
EXPORTERS TO EUROPE

We export the same good quality of lumbering tools that have made PINK'S TOOLS a by-word in the matter of good tools in all Canadian lumber camps. Enquiries cordially solicited.

Thomas Pink Co., Limited

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DIE CASTINGS

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Manufactured by



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A rearrangement of your patterns might cut their cost 25%; a different method of molding them might double your production at no increase in molding cost. *We can advise you* and we have expert metal and wood patternmakers who are able to make any changes that may commend themselves to you.

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send us a sample, blueprint or sketch, and ask for our advice. It won't cost you anything. If our advice is good and commends itself to you, it is only fair to assume that our work will be equally satisfactory, and we need the work as badly as you need the patterns.

We are in a position to do turning, boring, drilling or other semi-finishing operations on castings supplied by us.

ASK US

STEEL TUBING

FOR Agricultural Implements, Trolley Arms, Fence Posts, Bedsteads—and all kinds of manufacturing purposes. Reliable quality, uniform in size, 14 to 20 gauge, size ⅜″ to 2″ outside diameter.

STANDARD TUBE & FENCE COMPANY, LTD.
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A New and Better SAW TABLE

Saves Time and Space

This New McKenzie Saw Table has several outstanding features which make it the best machine of its kind to buy. Does the same work as machines of larger dimensions, costs less, takes up less space and produces work faster. It is 23½″ x 30″. Distance from saw to ripping fence is 13″. Floor space 30″ x 36″. Furnished with belt, ripping fence, two mitre fences and 9″ saw.

Specially suitable for pattern shops, technical and manual training schools. **Write for prices and full particulars.**

THE D. McKENZIE MACHINE CO.
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NAMCO -DIES-

There's a Namco Die for every thread cutting requirement-yours!



Four Points responsible for the production of clean-cut and accurate threads:

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Have you seen our new "Tap and Die" Book?

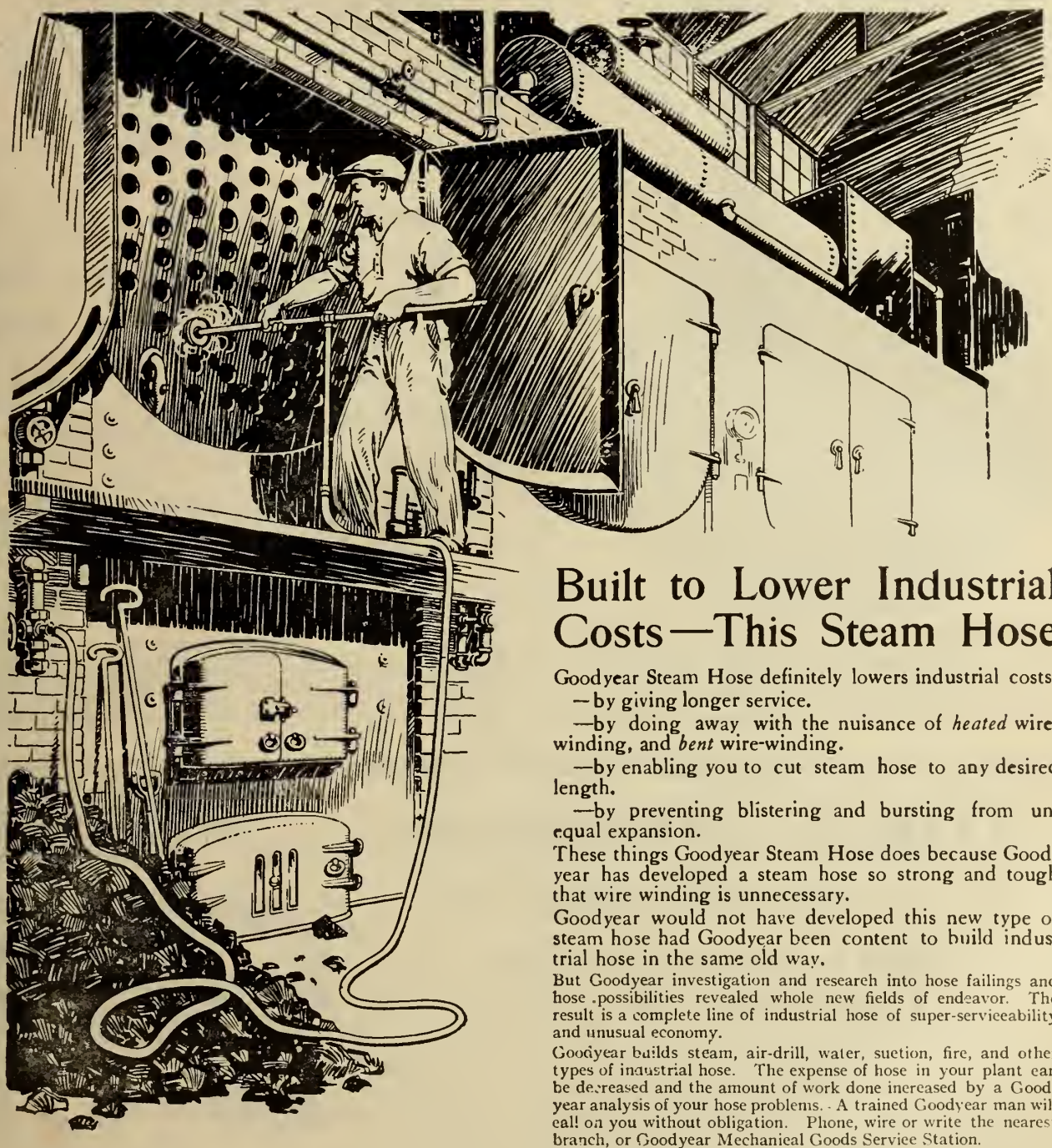
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Goodyear Steam Hose definitely lowers industrial costs:

—by giving longer service.

—by doing away with the nuisance of *heated* wire-winding, and *bent* wire-winding.

—by enabling you to cut steam hose to any desired length.

—by preventing blistering and bursting from unequal expansion.

These things Goodyear Steam Hose does because Goodyear has developed a steam hose so strong and tough that wire winding is unnecessary.

Goodyear would not have developed this new type of steam hose had Goodyear been content to build industrial hose in the same old way.

But Goodyear investigation and research into hose failings and hose possibilities revealed whole new fields of endeavor. The result is a complete line of industrial hose of super-serviceability and unusual economy.

Goodyear builds steam, air-drill, water, suction, fire, and other types of industrial hose. The expense of hose in your plant can be decreased and the amount of work done increased by a Goodyear analysis of your hose problems. A trained Goodyear man will call on you without obligation. Phone, wire or write the nearest branch, or Goodyear Mechanical Goods Service Station.

The Goodyear Tire & Rubber Co. of Canada, Limited

Branches—Halifax, St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, London, Winnipeg, Regina, Saskatoon, Edmonton, Calgary, Vancouver.

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There is some outstanding feature of all La Salle Grinding Machines that lends it exceptional productive ability.

The American Drill Grinder is especially adaptable for grinding twist, flat and three-lipped drills, because it has automatic lip rest and caliper jaw device, which assures proper clearance on all sizes of drills automatically. Send for descriptive matter covering our entire line of grinding machinery.



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For Wet or Dry Drill Grinding 1/8" to 2¼". Also 1/8" to 3½" dia.

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Original cost, length of service, accuracy of results —determine the economy of a reamer.

McCrosky-SUPER Adjustable Reamers

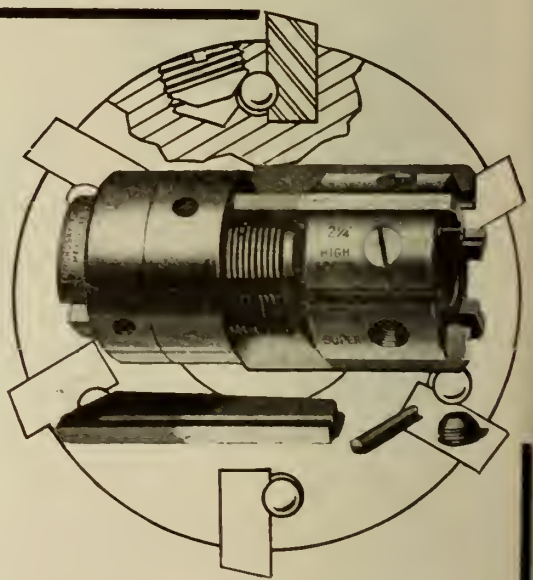
score on all three points.

In many sizes a High Speed McCrosky-SUPER costs less to buy than a solid high speed reamer.

Every McCrosky-SUPER with one set of blades can ream more holes than a dozen solid reamers. A new set of blades at a comparatively small cost makes a McCrosky-SUPER as good as new.

Large adjustment and a positive locking device insure constant accuracy to the last hole.

McCrosky Catalog No. 7 will show you how McCrosky-SUPER Reamers can save you money, and improve your product. *Send for a copy today.*



McCrosky-SUPER partly disassembled, showing Strength and Simplicity of construction.

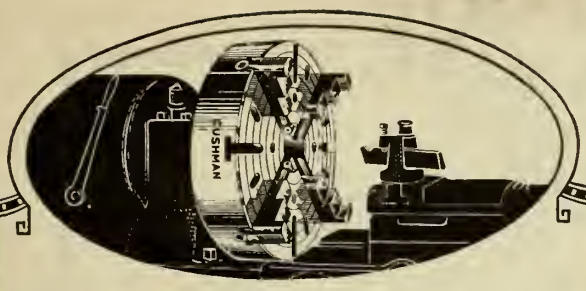
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FOR THE BUSINESS END OF YOUR LATHES

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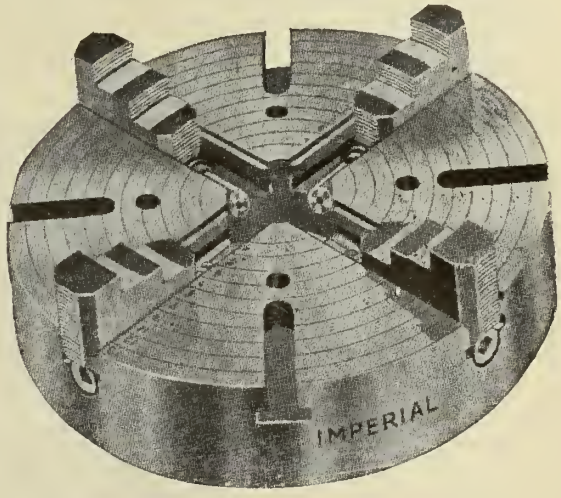
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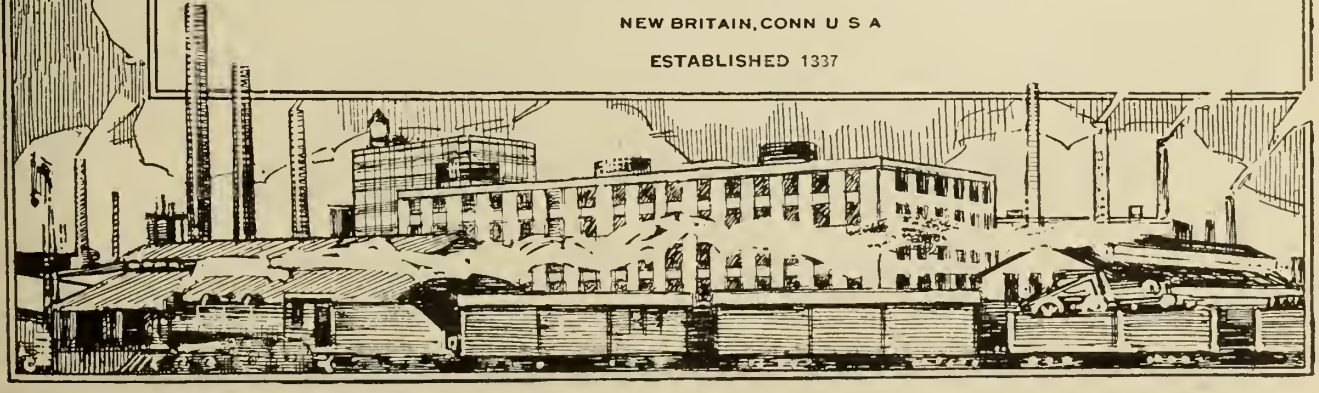
Workmen like them because they are easily, quickly and safely handled—manufacturers endorse them because they insure maximum service, reduction of production costs, increased capacity.

There is a Skinner Chuck for every class of work.

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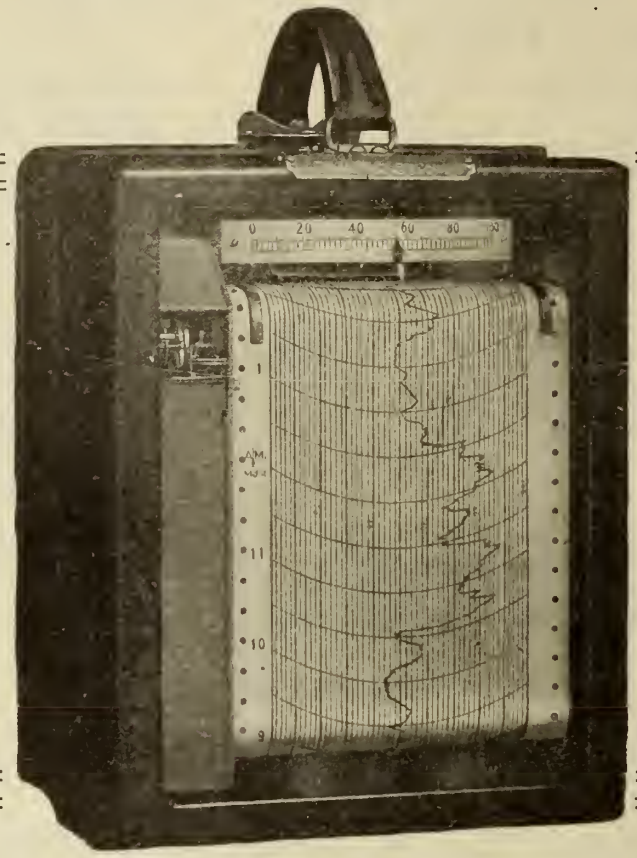


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Means Economy in Plant Operation

Portable and Switchboard Types



Graphic Wattmeters **Graphic Voltmeters** **Graphic Power-Factor Meters**

¶ Big savings can be effected by arranging power drives so that all machines are properly loaded. The best means of knowing what your equipment is doing is by taking readings with Esterline True Recording Wattmeters.

¶ The illustration shows one of the Portable Type, which is placed in an aluminum case with a glass face. The clock has an eight-day lever movement controlling the chart which is six inches in width and twenty-six feet long. A special inking device has been arranged for the marking of these charts. The holder will contain a supply for eight days and the ink is drawn through a tube to the pen by capillary action.

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Oxy-Acetylene and Electric Welding Supplies

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- 3/16 x 12 inches, per lb. 25c
- ¼ x 19 inches, per lb. 23c
- ⅜ x 19 inches, per lb. 18c
- ½ x 20 inches, per lb. 17½c

C.W. Norway Imported Welding Rods, for Wrought Iron and Steel—
- 3/16 x 36 inches, per lb. 23c
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- 3/32 x 36 inches, per lb. 22c
- ⅛ x 36 inches, per lb. 23c
- 3/16 x 36 inches, per lb. 22c
- ¼ x 36 inches, per lb. 20c

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Like the Genie of the "Arabian Nights," Prest-O-Lite is a wonderful force confined in a small cylinder.

It is subject to the command of its master—the trained welder and cutter. Under his direction it performs feats of wonder—anywhere, at any time.

In the subway builder's excavation, or in the floating dry dock, in fact any place—any time—where welding and cutting metals are required, the ready portability of Prest-O-Lite is an asset of genuine worth.

Ask us about the service plan of the Universal Gas with the Universal Service.



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IMPERIAL CARBIDE
MADE IN CANADA

It insures **effectiveness** and **economy** by **invariably** producing acetylene gas of **unusual purity.**

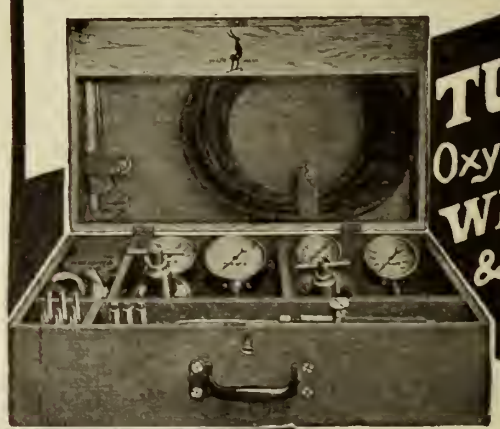
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For Repairing Broken Machinery or Tools of Medium Size

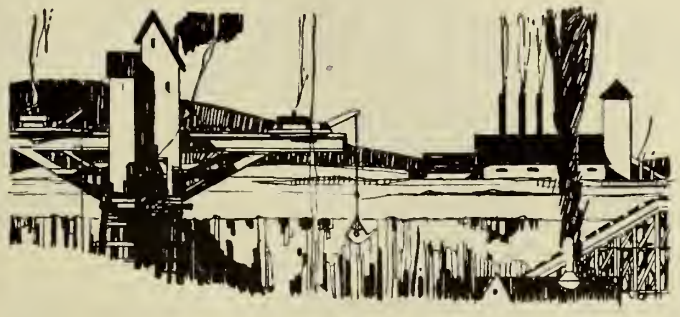


These outfits will soon pay their cost in machine parts or tools reclaimed. The sectional extensions of the torch enable the operator to adjust it to any desired length or angle. The location of valves is such that the flame is controlled by one hand, leaving the other hand free for the work at all times.

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Perfectype COMPLETE WELDING and CUTTING Equipment

Safe *Saves Money* *Makes Better Welds*

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Canadian orders for Perfectype Special Type "A" Cutwelding Torches with 90 degree cutting head and 2 cutting tips, standard angle welding head and 5 welding tips of pure red copper will be delivered, duty and postage prepaid, from nearest jobber at the special price of $65.00.

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National Electro Products Limited announce to the Welding Trade of Canada that they are now handling a complete line of Welding and Cutting Apparatus which has proven highly successful, and is employed by many of the largest users.

This Line Includes:

Oxy-Hydrogen Cutting Torches
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Regulators, Gauges, Hose, Goggles
Welding Rods, Fluxes, etc.

Electrolytic Oxygen and Hydrogen

are manufactured by the Company by an Electrolytic Process which assures gases of the highest purity. Factories are in operation in Toronto and Montreal, and others are under construction at different points.

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A Few Facts About Liquid Air Service

Liquid Air Service Department is composed of men who are specially selected for their expert practical and technical knowledge of the Oxy-Acetylene Process. They are at the disposal of all our customers to whom their services may be of use for which no charge is made and no obligation incurred.

In addition to our eight factories, five Distribution Stations have been established at St. John's, Nfld.; Sydney, N.S.; Quebec, Que.; Ottawa, Ont., and Windsor, Ont., respectively, for an immediate supply of Oxygen and Acetylene to consumers located in these Districts, with a minimum of freight rates and the elimination of delays occasioned by long distance haulage.

At the present time as in the past, L'Air Liquide is in a position to give service which is unassailable.

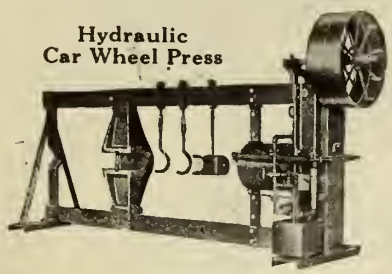


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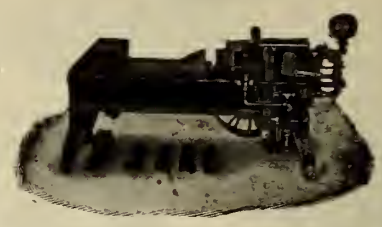
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The fact that "Hisco" Machine Molded Gears require no pattern is a factor of considerable importance when the price of lumber and labor is so high. "Hisco" quality insures accurate dependable gears. Remember—the price of "Hisco" gears does not include the cost of patterns.

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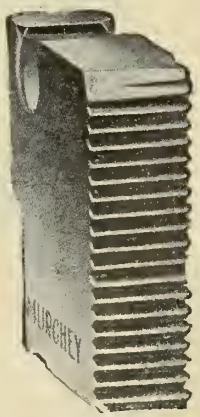


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Do quicker, better work, more economically

Murchey Tools will cut your tapping and threading costs and boost your production 50%. Every tool that comes out of the Murchey shop is as good as the finest materials, modern machinery, highly skilled labor and years of experience can make it. Wherever clean, accurate threading is required; there Murchey Taps and Dies will give the utmost satisfaction.

Send for a Murchey Tap and Die upon approval. Then by trial you can secure actual proof of its value to you.



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75 Porter Street, Detroit, Mich.

Coats Machine Tool Co., London, Glasgow, Newcastle, Eng.
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STEEL PLATE CONSTRUCTION

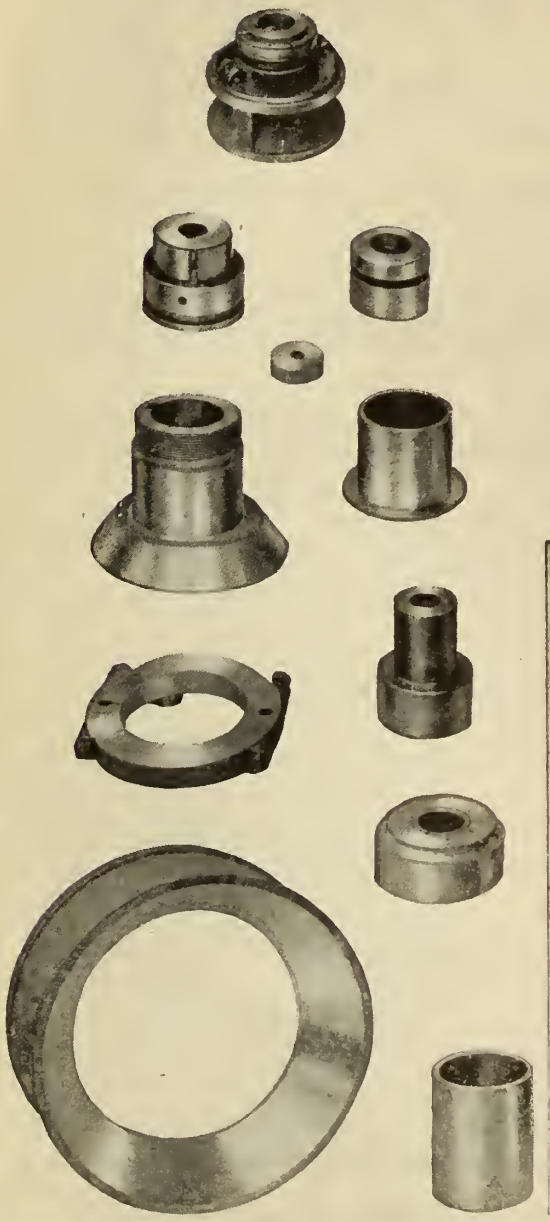
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FINISH

And Link-Belt Silent Chain Drives

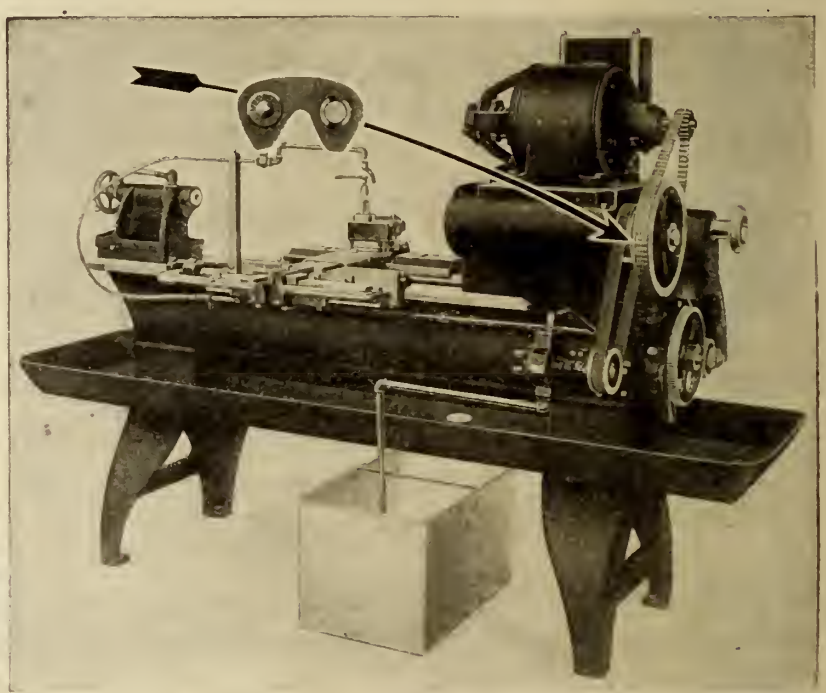


THESE illustrations show some recently-completed parts machined on tools driven by Link-Belt Silent Chain Drives. In reproducing them in halftone it is impossible to show the smooth, even finish on each part just as it left the machine tool —— But

Like all other parts completed on machine tools driven by Link-Belt Silent Chain Drives, these parts are smooth and clean cut, without chatter marks. Write for booklet No. 312 describing Link-Belt Silent Chain—the efficient drive for machine tools.

CANADIAN LINK-BELT
LIMITED

Wellington and Peter Sts. **TORONTO**



LINK-BELT
SILENT CHAIN DRIVES

DOMINION CHUCKS



Especially Adapted for Severe and Heavy Duty Work

BODY—The body is of heavy cross section and so designed to give broad and deep bearings for the jaws.

JAWS—The jaws are drop forgings, heat treated. The jaw is so designed that the threaded portion makes 180° contact with the screw.

SCREWS—The screws are large in diameter, broached at both ends and are reversible.

Dominion Chucks can be furnished in crucible or cast iron bodies

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Electric Railway Motor Gears and Pinions.

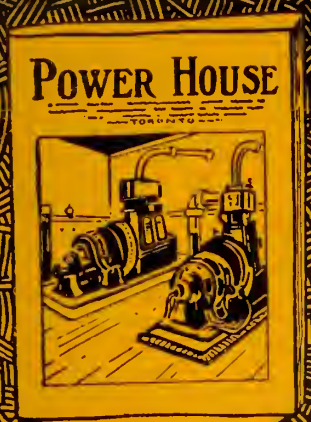
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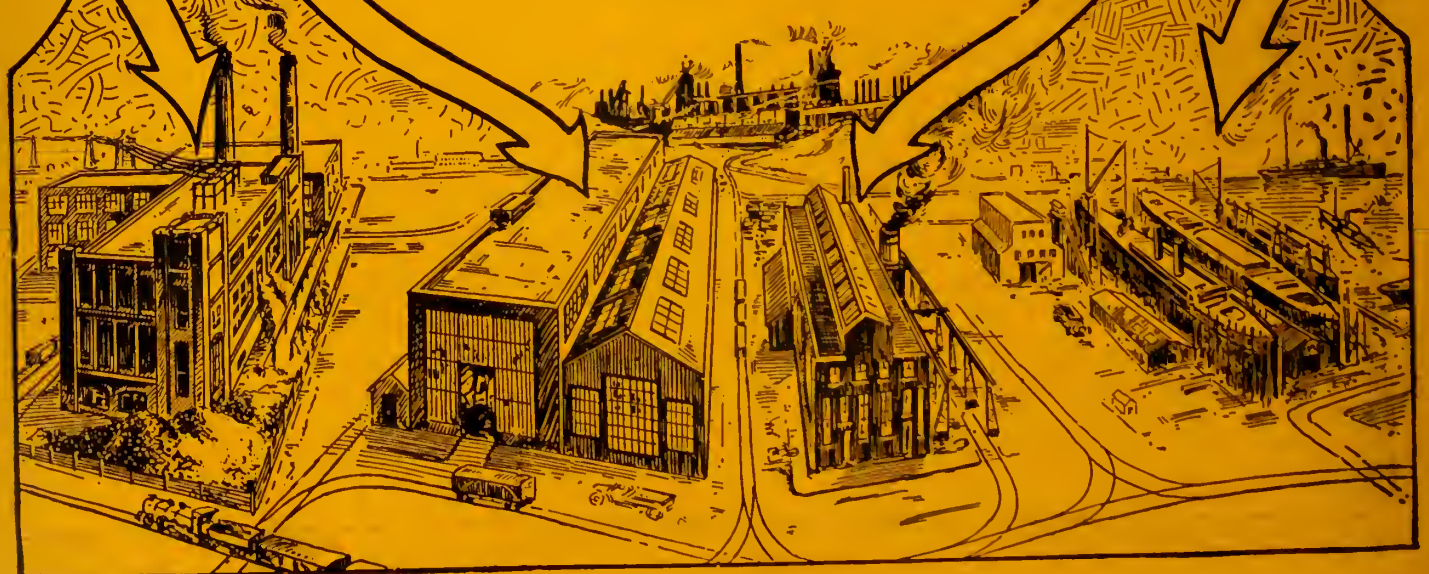
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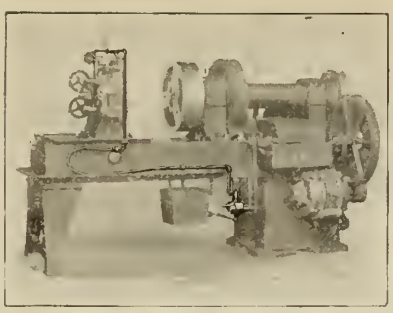
Our shops are equipped for building TURBINES of the largest sizes —also high speed PUMPS of large capacity for medium and low heads. Two turbines of 20,000 H.P. are now under construction.

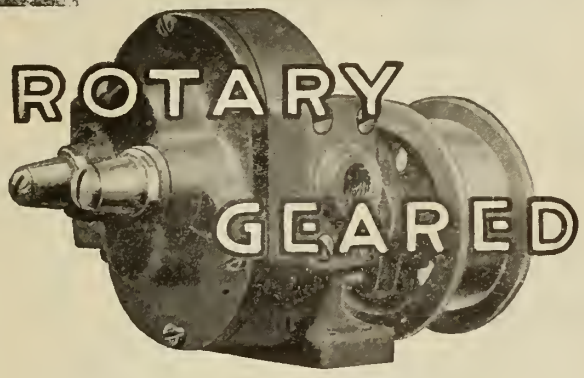
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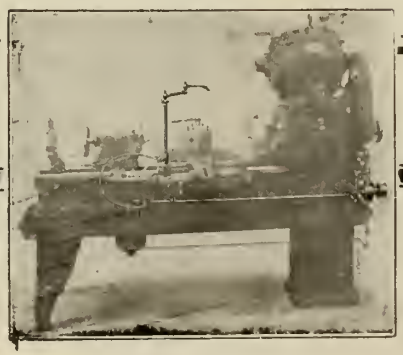


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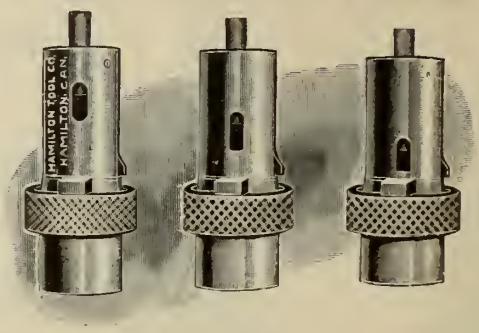
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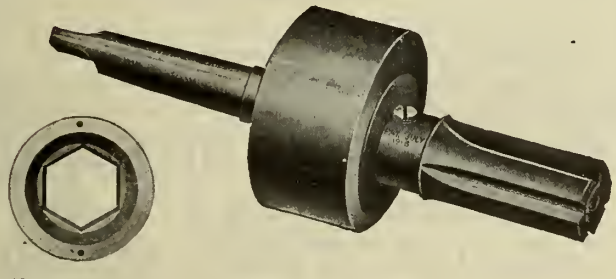
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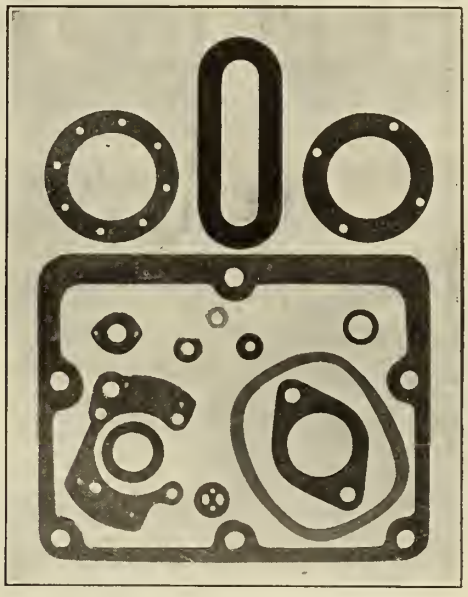
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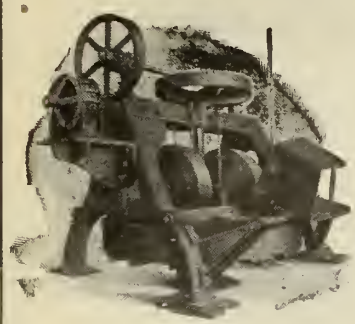
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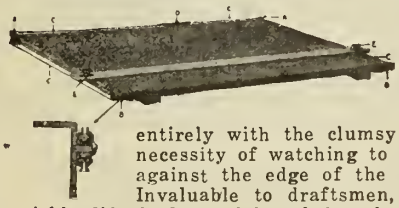
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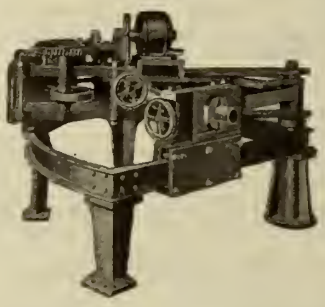
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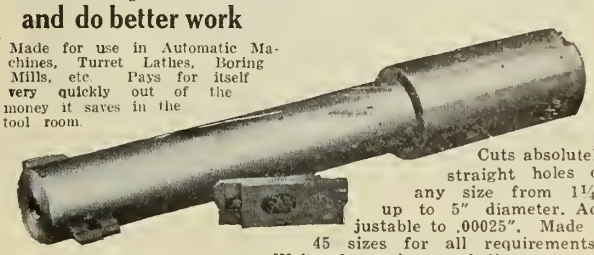
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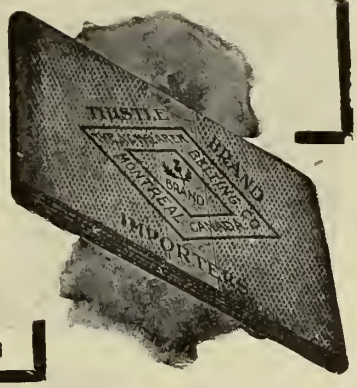
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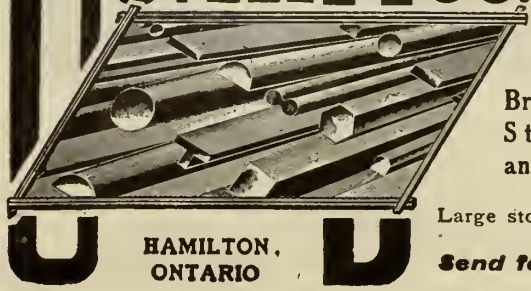
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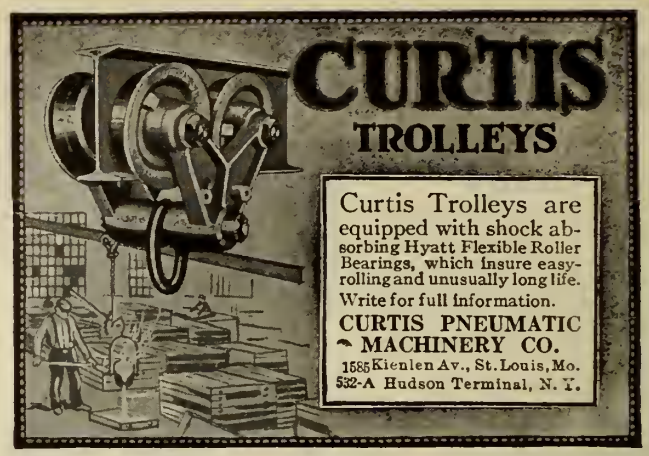
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Algoma Steel Corp., Sault Ste. Marie.
Peckovers, Ltd., Toronto, Ont.
United Alloys Steel Corporation, Canton, Ohio.

BASE FACING MACHINES
Victoria Foundry Co., Ottawa, Ont.

BATTERIES
Northern Electric Co., Ltd., Montreal, Que

BELT CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sumner & Co., New York, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

BEARINGS, GRAPHITE BRONZE
Lyman Tube & Supply Co., Montreal, Que.

BEARINGS, ROLLER
Lyman Tube & Supply Co. Montreal, Que.

BELT-LACING MACHINES, HOOKS AND PINS
Clipper Belt Lacer Co., Grand Rapids.

BELT LACING LEATHER
Aikenbead Hardware Co., Toronto, Ont.
G. F. Foss Mchy. & Sply. Co., Montreal.
Graton & Knight Mfg., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

BELTING, BALATA
Federal Engineering Co., Toronto, Ont.

BELT HOOKS, WIRE
Clipper Belt Lacer Co., Grand Rapids.

BELTING, RUBBER
Can. Consolidated Rubber Co., Montreal.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber Ltd., Toronto, Canada.

BELTING, CHAIN
Canadian Fairbanks-Morse Co., Montreal
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Renold of Canada, Ltd., Montreal.
Whitney Mfg. Co., Hartford, Conn.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, CONVEYOR
Can. Consolidated Rubber Co., Montreal.
Can. Link-Belt Co., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Federal Engineering Co., Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Graton & Knight Mfg., Worcesteb, Mass.
International Mchy. Spls., Ltd., Montreal
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McLaren Belting Co., J. C., Montreal.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co., Philadelphia, Pa.
Rice, Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Sumner & Co., New York, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, FRICTION AND SURFACE
Can. Con. Rubber Co., Ltd., Montreal.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, HAIR
Sumner & Co., New York, N.Y.

BELTING, LEATHER
Can. Graton & Knight Mfg. Co., Montreal
Gutta Percha & Rubber, Ltd., Toronto, Canada.

BELTING, RUBBER
International Mchy. Spls. Ltd., Montreal.
Quaker City Rubber Co., Philadelphia, Pa.

BELTING, STITCHED COTTON DUCK
Dominion Belting Co., Hamilton, Ont.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, WOVEN
Federal Engineering Co., Ltd., Toronto.
Sumner & Co., New York, N.Y.

BENDING MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.
Bertarm & Sons Co., John, Dundas.
Brown-Boggs Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Kitchener.
Dom. Steel Product Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BLAST GATES
W. S. Rockwell Co., New York, N.Y.

BLASTING MACHINES, SAND
Garlock-Walker Machinery Co., Toronto.
Jardine, A. B., & Co., Hespeler, Ont.
National Mach. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Toledo Machine & Tool Co., Toledo.
Williams Mchy Co., A. R., Toronto, Ont.

BILLETS
Atkins & Co., Wm., Sheffield, Eng.
Swedish Steel & Importing Co., Ltd., Montreal.
Algoma Steel Corp., Sault Ste. Marie.
Marshall, Son & Bunney, Toronto.
United Alloy Steel Corp., Canton, Ohio.

BILLETS, FORGING
Dominion Foundries & Steel Ltd., Hamilton, Ont.

BINS, STEEL
Dennis Wire & Iron Works, London, Ont.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto, Ont.
William Hamilton Co., Peterboro, Ont.

BLACKSMITH WORK
The Thos. Pink Co., Ltd., Pembroke.

BLOCKS, CHAIN
Oliver Engineering Co., Montreal.

BLOOMS AND SLABS
Algoma Steel Corp., Sault Ste. Marie.
United Alloy Steel Corp., Canton, Ohio.

BLOWERS
Can. Blower & Forge Co., Kitchener, Ont.
Garlock-Walker Machinery Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.

BLOWING ENGINES
General Combustion Co., Ltd., Montreal, Que.

BLOW PIPES AND REGULATORS
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.

BLUE PRINTING MACHINERY
Commercial Camera Co., Providence, R.I.

BLUE PRINT PAPER
Hughes, Owens Co., Ltd., Montreal, Que.

BOARTZ
Joyce, Koebel & Co., Inc., New York.

BOILER TUBES
Lyman Tube & Supply Co., Montreal, Que.

BOILER BREECHINGS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
William Hamilton Co., Peterboro, Ont.

BOLT CUTTERS
Fellows Gear Shaper Co., Springfield, Vt.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOILERS, RANGE
Can. John Wood Mfg. Co., Ltd., Toronto.

BOILERS
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.

BOILERMAKERS' TOOLS
Holden & Co., Ltd., Montreal, Que.

BOLT CUTTERS AND NUT TAPERS
Aikenbead Hardware Co., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Landis Machine Co., Waynesboro, Pa.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOLTS
Aikenbead Hardware Co., Toronto, Ont.
London Bolt & Hinge Wks., London, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Rice, Lewis & Son, Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton
Wilkinson & Kompass, Hamilton, Ont.
Williams & Co., J. H., Brooklyn, N.Y

BOLTS, COUPLING
Galt Machine Screw Co., Ltd., Galt, Ont.

BOLTS, STAY
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, SPRING SHAKLE
Can. Winkley Co., Ltd., Windsor, Ont.
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, PATCH
Morrow Screw & Nut Co., John, Ingersoll

BOLT AND NUT MACHINERY
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Mchy Co., A. R., Toronto, Ont.

BOLT THREADING MACHINERY
Jardine & Co., Ltd., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

BONDING MACHINES (Electric Railway)
The Lincoln Electric Co., Toronto, Ont.

BORING MACHINES, PNEUMATIC CYLINDER
Cleveland Pneumatic Tool Co., Toronto.
Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto.

BORING MACHINES, UPRIGHT AND HORIZONTAL
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Herbert, Ltd., Alfred, Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Hoefer Mfg. Co., Freesport, Ill.
Landis Tool Co., Waynesboro, Pa.
Oliver Machinery Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Rockford Drilling Mche. Co., Rockford. Ill.
Strelinger Chas. A. Co., Windsor, Ont.

BORING AND TURNING MILLS
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Foss Mch. & S'ply Co., Geo. F., Montreal
Herbert, Ltd., Alfred, Toronto, Ont.
Oliver Mach. Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.
Strelinger Chas. A. Co., Windsor, Ont.

BOXES, CAST IRON
Brown & Sharpe Mfg. Co., Providence, R.I.

BOXES, STEEL SHOP AND TOTE
Cleveland Wire Spring Co., Cleveland.

BARKES
Brown, Boggs & Co., Hamilton, Can.
Electric Steel & Metals, Ltd., Welland.

BRASS—SHEETS, ROLLS, PLATES, AND RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRASS ALLOYS
British Smelting & Refining Co., Ltd., Montreal, Que.

BRASS AND COPPER TUBING
Lyman Tube & Supply Co., Montreal, Que.

BRASS FOUNDERS
Canada Metal Co., Toronto.
Tallman Brass & Metal Co., Hamilton.

BRASS GOODS
Crane, Ltd., Montreal, Que.

BRASS PIPE AND TUBE
Crane, Ltd., Montreal, Que.

BRASS WORKING MACHINERY
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machinery Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Prest-O-Lite Co., Inc., Toronto, Ont.
Wood Turret Machine Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.
Brown's Copper and Brass Rolling Mills, New Toronto.

BRICKS, FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton. Ont.

BRIDGES, RLY. AND HIGHWAY
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

BROACHING MACHINES
Strelinger, Chas. A. Co., Windsor, Ont.

BRONZE—SHEETS, ROLLS. PLATES AND RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRONZE, NAVAL
Canada Metal Co., Toronto.

BRONZE COPPER
Tallman Brass and Metal Co., Hamilton.
Canada Metal Co., Toronto.

BRUSHES, CARBON
Lyman Tube & Supply Co., Montreal, Que.

BUFFING AND POLISHING MACHINERY
Ford-Smith Mach. Co., Hamilton.
Foss Mchy. & S'ply Co, Geo. F., Montreal
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BUCKETS, DUMP
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

BUCKETS, ELEVATOR
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

BUCKETS, CLAM SHELL, CRAB, DUMP
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd., Walkerville.

BULLDOZERS
Bertram & Sons Co., John, Dundas.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford
Garlock-Walker Machinery Co., Toronto.
Lourie Mfg. Co., Springfield, Ill.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

BURNERS, OIL AND NATURAL GAS
Northern Crane Works, Ltd., Walkerville.
W. S. Rockwell Co., New York, N.Y.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque.

BUSHING, BRONZE
Morrow Screw & Nut Co., John, Ingersoll

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CABLES, TRANSMISSION AND TELEPHONES
Northern Electric Co., Ltd., Montreal.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Carter Welding Co., Ltd., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Union Carbide Co., of Canada, Limited, Weland, Ont.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville.
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co., Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glasco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

CAR MOVERS
Holden Co., Ltd., Montreal, Que.

CASES, FILING
Economy Drawing Table Co., Adrian. Mich.

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Can. Metal Co., Toronto, Ont.

CASTINGS, DIE CAST
Can. Metal Co., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.
Fisher Motor Co., Ltd., Orilla, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

CASTINGS, STEEL—ALL KINDS
Canada Electric Castings, Ltd., Orilla, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co., Ltd., Orilla, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.

CARRIERS COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll.
Alexander Fleck Ltd., Ottawa.
Tallman Brass & Metal Co., Hamilton

CASTINGS, BENCH LEG
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt, Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown, Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co., Ltd., Orilla, Ont.
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
Interantional Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.
McFarlane Engineering Ltd., G. W., Paris, Ont.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd., Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Morrow Screw & Nut Co., J., Ingersoll.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machinery Co., Toronto.
Lyman Tube & Supply Co., Montreal, Q.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.
Renold of Canada, Ltd., Montreal.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Renold of Canada, Ltd., Montreal.
Williams Mchy. Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterhorough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Can. Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N. Y.
Glasgow, N.S.
Renold of Canada, Ltd., Montreal.

CHAINS, SPROCKET WHEEL
Can. Link Belt Co., Ltd., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Ltd., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Labatory, Ltd., Toronto.

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, COLLET, AIR
Petrie, Ltd., H. W., Toronto.
Williams Mchy. Co., A. R., Toronto.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford
Foss Mchy. & Sply Co., Montreal.
Gardner, Robt. & Son, Montreal.
Garlock-Walker Machinery Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Herbert, Ltd., Alfred, Toronto, Ont.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Strelinger, Chas. A. Co., Windsor, Ont.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Warner & Swasey Co., Cleveland, O.
Williams Mchy. Co., A. R., Toronto, Ont.

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAY FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York, N.Y.

CLOCK SPRINGS
The Dunbar Brothers Co., Bristol, Conn

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.

CLOSETS
Crane, Ltd., Montreal, Que

CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

COAL CRUSHERS
Can. Link-Belt Co., Ltd., Toronto, Ont.

COAL HANDLING MACHINERY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Nova Scotia Steel & Coal Co., New

COLD ROLLED STRIP, ALL METAL COLLARS, SHAFTING
Can. Driver-Harris Co., Ltd., Walkerville.
Williams & Co., J. H., Brooklyn, N.Y.

COLLECTORS, PNEUMATIC
Can. Blower & Forge Co., Kitchener
Sturtevant Co., B. F., Galt, Ont.

COMPOSITION INGOT
Canada Metal Co., Toronto.

COMPOUNDS, CUTTING AND GRINDING, DRAWING STAMPING
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR
Atkins & Co., E. C., Hamilton, Ont.
Can. Ingersoll-Rand Co., Sherbrooke.
Cleveland Pneumatic Tool Co., Toronto
Curtis Pneumatic Machy. Co., St. Louis
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Superior Machinery Co., London, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CONDENSERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
MacGovern & Co., Montreal, Que.

CONDUITS
Northern Electric Co., Ltd., Montreal, Que.

CONNECTING RODS
Canada Found'g & Forgings, Ltd., Welland, Ont.

CONNECTING ROD CUTTERS INTERCHANGEABLE
Eclipse Counter bore Co., Ltd., Walkerville, Ont.

CONTRACT WORK
Brown Engineering Corp., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
Globe Engineering Co., Hamilton, Ont.
Katie Foundry, Ltd., Galt, Ont.
Victoria Foundry Co., Ottawa.

CONTROLLERS, MAGNETIC BRAKES, ELECTRIC WINCHES, MONO RAIL HOISTS
Volta Mfg. Co., Welland, Ont.

CONTROLLERS AND STARTERS
Williams Mach'y. Co., A. R., Toronto.

Morton Travelling Head Planer

Handles Large or Small Work With Equal Economy

With the Morton Travelling Head Planer you can tackle the most difficult jobs with the certainty of being able to complete them economically and expeditiously. It handles both large and small work with maximum economy.

The multiplicity of operations of the Morton Travelling Head Planer makes possible the complete machining of difficult jobs at one setting of the casting. This tool operates as a draw-cut planer but may be quickly converted to operate with a push cut. It bores, mills and drills at right angles to the ram, as well as in the same plane. Special attachments may be obtained for spherical boring.

Special Features

It may be used either as a portable or stationary machine as the bottom side of the bed is planed.

It is reversible and may be quickly converted into a large, horizontal, travelling head slotter.

All milling, boring and planing feeds and adjustments may be quickly changed to meet conditions.

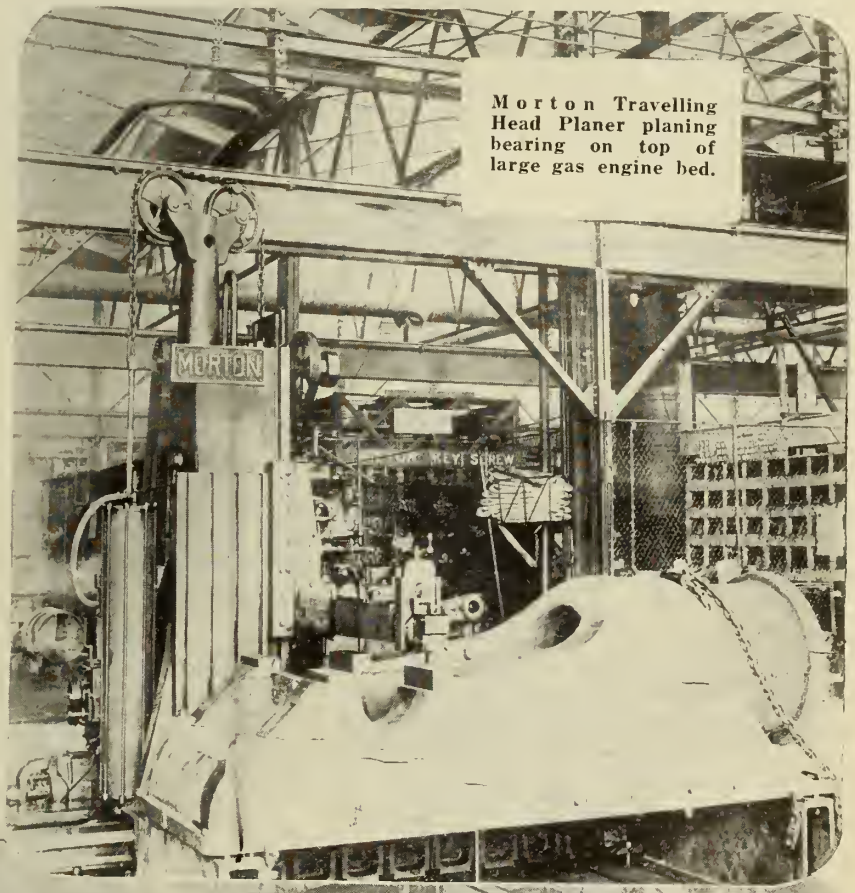
It will vertical mill and drill at right angles with the ram, at any 90-degree point of an arc.

Every operating lever is within easy reach of the operator.

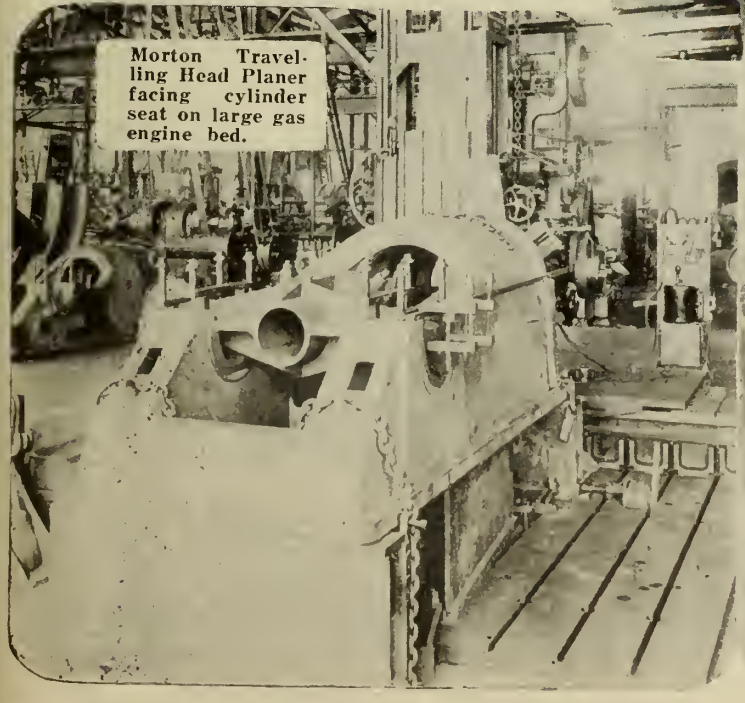
It requires one-half the floor space and one-fourth the power of a housed planer of equal capacity.

Complete Information in Bulletin No. 8 A
Write for it to-day.

Morton Mfg. Co.
Muskegon Heights, Mich., U. S. A.



Morton Travelling Head Planer planing bearing on top of large gas engine bed.



Morton Travelling Head Planer facing cylinder seat on large gas engine bed.



Morton Travelling Head Planer facing journal end on large gas engine bed.

CONTROLLING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

CONVERTERS, ROTARY
MacGovern & Co., Montreal, Que.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.

COOLERS, WITH DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co. Haydenville, Mass.

COPING MACHINES
Bertram & Sons Co., John, Dundas, Ont.
Dom. Steel Products Co., Ltd., Brantford
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Can. Blower & Forge Co., Kitchener.

COPPER, BUS BAR, SHEET, PLATES, RODS
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper and Brass Rolling Mills, New Toronto.

CORE OIL
Swan & Finch, Inc., 165 Broadway.

COUNTERBORES AND COUNTERSINKS
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.

COUNTERSINKS, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

COUNTERBORES, INVERTED, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

COUNTERSHAFTS
Almond Mfg. Co., Ashburnham, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Baird Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., Ltd., A. R., Montreal
Williams Mchy Co., A. R., Toronto.

COUPLINGS, FRICTION
Bernard Industrial Co., The A., Fortierville, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto.

COUPLINGS, RAPID HOSE
Ont. Machinery & Supply Co., Ltd., Montreal, Que.

COILING MACHINERY, WIRE AND SPRING
Garlock-Walker Machinery Co., Toronto.

BUCKET
Hanna & Co., M. A., Cleveland, O.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Cleveland Pneumatic Tool Co. of Canada, Toronto.

CRANES, OVERHEAD, HAND AND
Gardner, Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago

CRANES, LOCOMOTIVE
Can. Liuk-Belt Co., Ltd., Toronto, Ont.
Northern Crane Works, Walkerville.

ELECTRIC
Volta Manufacturing Co., Welland, Ont.

CUPS, OIL
Can. Winkley Co., Ltd., Windsor, Ont.

COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.

CRANES, GRAVITY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

CRANE RUNWAYS
MacKinnon Steel Co., Sherbrooke, Que.

CRANES, JIB
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, LOCOMOTIVE
Brown Hoisting Machinery Co., Cleveland, Ohio.
Holden Co., Ltd., Montreal, Que.

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Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane and Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville.
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CRANES, PILLAR
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, PORTABLE
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Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy. Co., A. R. Toronto, Ont.

CRANES, TRAVELLING, ELECTRIC AND HAND POWER
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Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Oliver Engineering Co., Montreal.

CRANK SHAFTS
Can. Found's & Forgings Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.

CRANK PIN TURNING MACHINE
Herbert, Ltd., Alfred, Toronto, Ont.

CRIMPS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass.

CRUSHERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.

CUPOLAS
Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.

CURB PUMPS FOR OIL, GASOLINE
Bowser Co. Ltd., S. F., Toronto, Ont.

CURRENT TRANSFORMERS
Volta Manufacturing Co., Welland, Ont.

CUT-OFF COUPLINGS, FRICTION
Petrie, Ltd., H. W., Toronto.

CUTTERS, BOLT
See Bolt Cutters.

CUTTERS, GEARS
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto

CUTTER HEADS
Oliver Machinery Co., Grand Rapids, Mich.

CUTTERS, PIPE (See Pipe Cutters)

CUTTERS, HIGH SPEED
Madison Mfg. Co., Madison, Wis.

CUTTERS, MILLING
Butterfield & Co., Rock Island, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Sply. Co., G. F., Montreal.
Garvin Machine Co., New York.
Ingersoll Mache. Co., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg. Co., Hartford, Conn.
Wilt Twist Drill Co., Walkerville, Ont

CUTTER RELIEVING MACHINES
Cleveland Milling Machine Co., Cleveland

CUTTING-OFF MACHINES
Armstrong Bros., Tool Co., Chicago.
Atkins & Co., E. C., Hamilton, Ont.
Bertram & Sons Co., John, Dundas.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
G. F. Foss Mchy. & Sply. Co., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass.
Kennedy & Sons, Wm., Owen Sound
Lyman Tube & Supply Co., Montreal, Que.
Niles-Bement-Pond Co., New York.
Prest-O-Lite Co., Inc., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Williams Tool Corp. of Canada, Ltd., Brantford, Ont.
Wells Bros., of Can., Galt, Ont.
Williams Mchy. Co., A. R., Toronto, Ont.

CUTTING COMPOUND AND CUTTING OIL
Cataract Refining Co., Ltd., Toronto
Swan & Finch, Inc., New York.

CUTTING OIL, RECLAIMING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

CUTTING AND WELDING PLANTS
Davis-Bournonville Co., Jersey City, N.J.
Prest-O-Lite Co., Inc., Toronto, Ont.

CYANIDE AND LEAD BATH POTS
Swedish Crucible Steel Co., Windsor.

CYLINDERS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton, Ont.

REHUMIDIFYING
R. F. Sturtevant Co., Galt, Ont.

DERRICKS
Aikenhead Hardware Co., Toronto, Ont.
Dominion Bridge Co., Montreal.
Hepburn Co., Ltd., J. T., Toronto, Ont.
Morris Crane & Hoist Co., Sherbrook.

DIAMOND (BORTZ)
Furniss, Clarke & Co., Montreal, Que.

DIAMOND TOOLS
Can. Desmond-Stephan Mfg. Co., Hamilton.
Ford-Smith Machine Co., Hamilton, Ont.
Furniss Clark & Co., Montreal, Que.
Joyce-Koebel Co., Inc., New York City
Wheel Trueing Tool Co., Detroit.
Petrie Ltd., H. W., Toronto.

DIAMONDS, CARBON AND BORTZ
Joyce Koebel Co., Inc., New York, N.Y.
Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.

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Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

DIE HEADS, AUTOMATIC
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

DIES FOR BIT BRACE USE
Butterfield & Co., Rock Island, Que.
Crescent Mchc. Co., Ltd., Montreal, P.Q.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Wells Brothers Co., of Canada, Galt.

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Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Brown, Boggs Co., Hamilton, Ont.
Crescent Mchc. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
Herbert Ltd., Alfred, Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Jones & Lamson, Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Stoll Co., Inc., D. H., Anfalo, N.Y.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Brothers of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DIES, HAMMERED
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, DROP FORGE.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, METAL STAMPING
Ackworthie Ltd., J., Birmingham, Eng.
Crescent Mchc. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall, Galt, Ont.

DIES, PIPE THREADING
Ackworthie Ltd., J., Birmingham, Eng.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Crescent Mchc. Co., Ltd., Montreal, P.Q.
Landis Machine Co., Waynesboro, Pa.

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Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Crescent Machine Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros. of Can., Galt, Ont.

DIE SINKERS
Ackworthie Ltd., J., Birmingham, Eng.
Garvin Machine Co., New York.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.
Pratt & Whitney Co., Dundas, Ont.
Walcott Lathe Co., Jackson, Mich

DIES FOR MACHINES
Ackworthie Ltd., J., Birmingham, Eng.
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que.
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt.

DIE HEADS
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros. of Canada, Galt, Ont.

DIES, SELF-OPENING
Geometric Tool Co., New Haven
Herbert, Ltd., Alfred, Toronto, Ont.
Landis Machine Co., Waynesboro, Pa
Murchey Machine & Tool Co., Detroit
Wells Brothers Co. of Can., Galt, Ont
Petrie, Ltd., H. W., Toronto
Strelinger, Chas. A. Co., Windsor, Ont.

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Oliver Mach. Co., Grand Rapids, Mich

DIE STEEL, HOT AND COLD WORK
Armstrong-Whitworth of Can., Montreal
Atkins & Co., Ltd., Wm., Sheffield, Eng
Marshall, Son & Bunney, Toronto.
Firth & Sons, Thos., Montreal, Que.

DIES FOR SCREW PLATES
Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Wells Bros. Co. of Can., Galt, Ont.

DIES, SHEET METAL WORKING
Ackworthie Ltd., J., Birmingham, Eng.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Globe Engineering Co., Hamilton, Ont
Stoll Co., D. H., Buffalo, N.Y.

DIES, SCREW AND THREAD
Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros., Co., of Can., Galt, Ont

DISCS, LEATHER, STEEL
Graton & Knight Mfg. Co., Worcester, Mass.

DIRECT CONNECTED UNITS
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DRAFT, MECHANICAL
Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sturtevant Co., B. F., Galt, Ont.

DRAINAGE FITTINGS
Crane, Ltd., Montreal, Que.

DRAWING INSTRUMENTS
Hughes, Owens Co., Ltd., Montreal, Que.

DRAWING OFFICE SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

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Atkins & Co., E. C., Hamilton, Ont.
Can. Desmond-Stephan Mfg. Co., Hamilton
Dominion Abrasive Co., Ltd., Mimico, Ont
Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont.

DRILL PRESSES
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Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
U. S. Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto.

DRILL RODS
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Lincoln Electric Co. of Canada, Ltd Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Swedish Steel & Importing Co., Ltd., Montreal.

DRILLING MACHINES, GANG
Bilton Mach. Tool Co., Bridgeport, Conn
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Petrie, Ltd., H. W., Toronto.
Silver Mfg. Co., Salem, Ohio.
Strelinger, Chas. A. Co., Windsor, Ont.

DRILLING MACHINES, LOCOMOTIVE AND MULTIPLE SPINDLE
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Can. Blower & Forge Co., Kitchener, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Mach. Co., Toronto.
Garvin Machine Co., New York.
Hoefer Mfg., Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
Nat. Automatic Tool Co., Richmond, Ind.
Niles-Bement-Pond Co., New York.
Rockford Drilling Mach Co., Rockford, Ill
Strelinger, Chas. A. Co., Windsor, Ont.

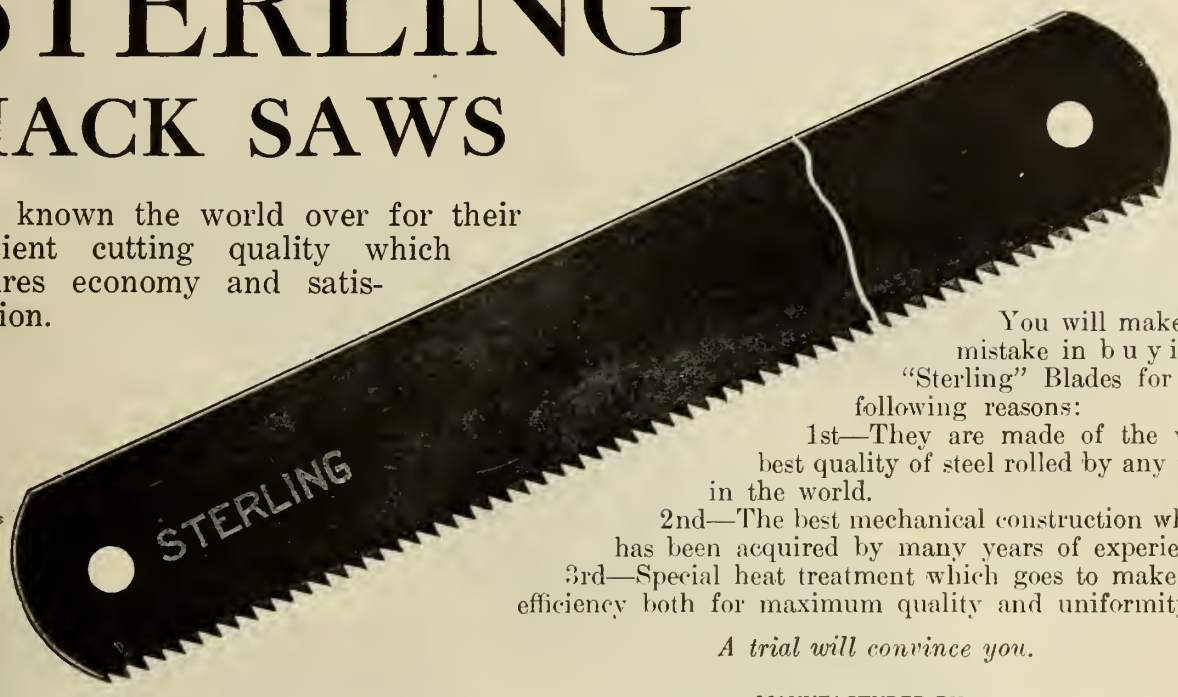
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Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Herbert, Ltd., Alfred, Toronto, Ont.
Henry & Wright Mfg. Co., Hartford.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLING MACHINES, SENSITIVE
Bilton Mach. Tool Co., Bridgeport, Conn.
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Canadian Machinery Corp., Galt, Ont.
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Garlock-Walker Mach. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert, Ltd., Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
United States Mach. Tool Co., Cincinnati
Williams Mchy Co., A. R., Toronto, Ont.

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Canada Mach. Corp., Galt, Ont.
Garvin Machine Co., New York.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mach. Co., Toronto, Ont.
Herbert, Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
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A. R. Williams Machinery Co., Toronto

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Hoefer Mfg. Co., Freeport, Ill.

DRILLING POSTS
Aikenhead Hardware Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Silver Mfg. Co., Salem, Ohio.

DRILLS, BENCH
Aikenhead Hardware Co., Toronto.
Can. Blower & Forge Co., Kitchener.
Can. Fairbanks-Morse Co., Montreal.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Machinery Co., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

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Can. Blower & Forge Co., Kitchener.
Cleveland Twist Drill Co., Cleveland.
Geo. F. Foss Mch. & S'ply Co., Montreal
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Can., Walkerville

DRILLS, CENTRE
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilt Twist Drill Co. of Can., Walkerville

DRILLS CORE INTERCHANGEABLE
Eclipse Countersunk Co., Ltd., Walkerville, Ont.

DRILLS, CARBON
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
John Morrow Screw & Nut Co., Ingersoll

DRILLS, ELECTRIC, CORNER
Holden Co., Ltd., Montreal, Que.

DRILLS, ELECTRIC, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
Cincinnati Electrical Tool Co., Cincinnati
Geo. F. Foss Mch. & S'ply Co., Montreal
Haskins Co., R. C., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pilot Steel & Tool Co., Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
Strelinger Co., C. A., Windsor, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
A. R. Williams Mach. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, HAMMER
Samuel Osborne, Ltd., Montreal, P.Q.

DRILLS, EMERY
Garlock-Walker Mach. Co., Toronto, Ont.

DRILLS, HIGH SPEED TWIST
Aikenhead Hardware Co., Toronto, Ont.
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd. Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal
H. A. Drury Co., Montreal.
Geo. F. Foss Mch. & S'ply Co. Montreal
Herbert, Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll Ont
Morse Twist Drill & Machine Co., New Bedford, Mass.
Osborne, Samuel, Montreal, P.Q.
Pratt & Whitney Co., Dundas, Ont.
Petrie, H. W. Toronto.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies Montreal.
Strelinger Co., Chas. A., Windsor, Ont.
Taylor Stair Rldg. Toronto.
Wilt Twist Drill Co. of Can., Walkerville
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, OIL TUBE
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

DRILLS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Williams Mchy Co., Ltd., A. R., Montreal
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, PNEUMATIC CORNER
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Chicago.

DRILLS, RATCHET AND HAND
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

DRILLS, ROCK
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
The Foss Mchy. & Supply Co., Montreal.
Holden Co., Ltd., Montreal, Que.
Samuel Osborne Ltd., Montreal, P.Q.
Strelinger, Chas. A. Co., Windsor, Ont.
A. R. Williams Machy. Co., Toronto.

DRILLS, SQUARE & HEXAGON
Globe Engineering Co.

DRILLS, TRACK
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Holden Co., Ltd., Montreal, Que.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

DRINKING FOUNTAINS, SANITARY
Crane, Ltd., Montreal, Que.
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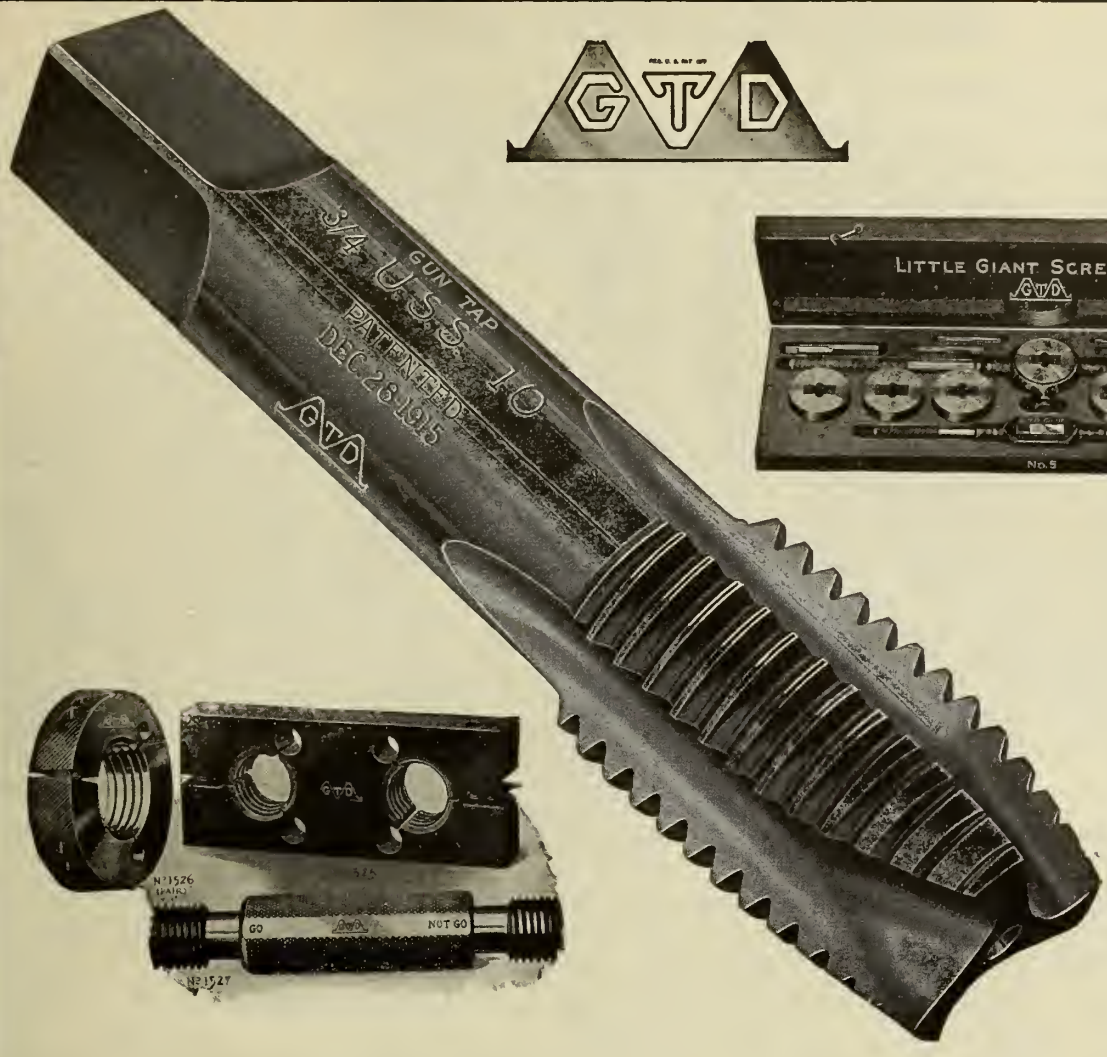
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Williams Mchy Co., A. R., Toronto, Ont

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Petrie, Ltd. H. W., Toronto.
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Williams Mchy Co, Ltd., A. R., Montreal

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HIGH SPEED STEEL
See Steel.

HINGE MACHINERY
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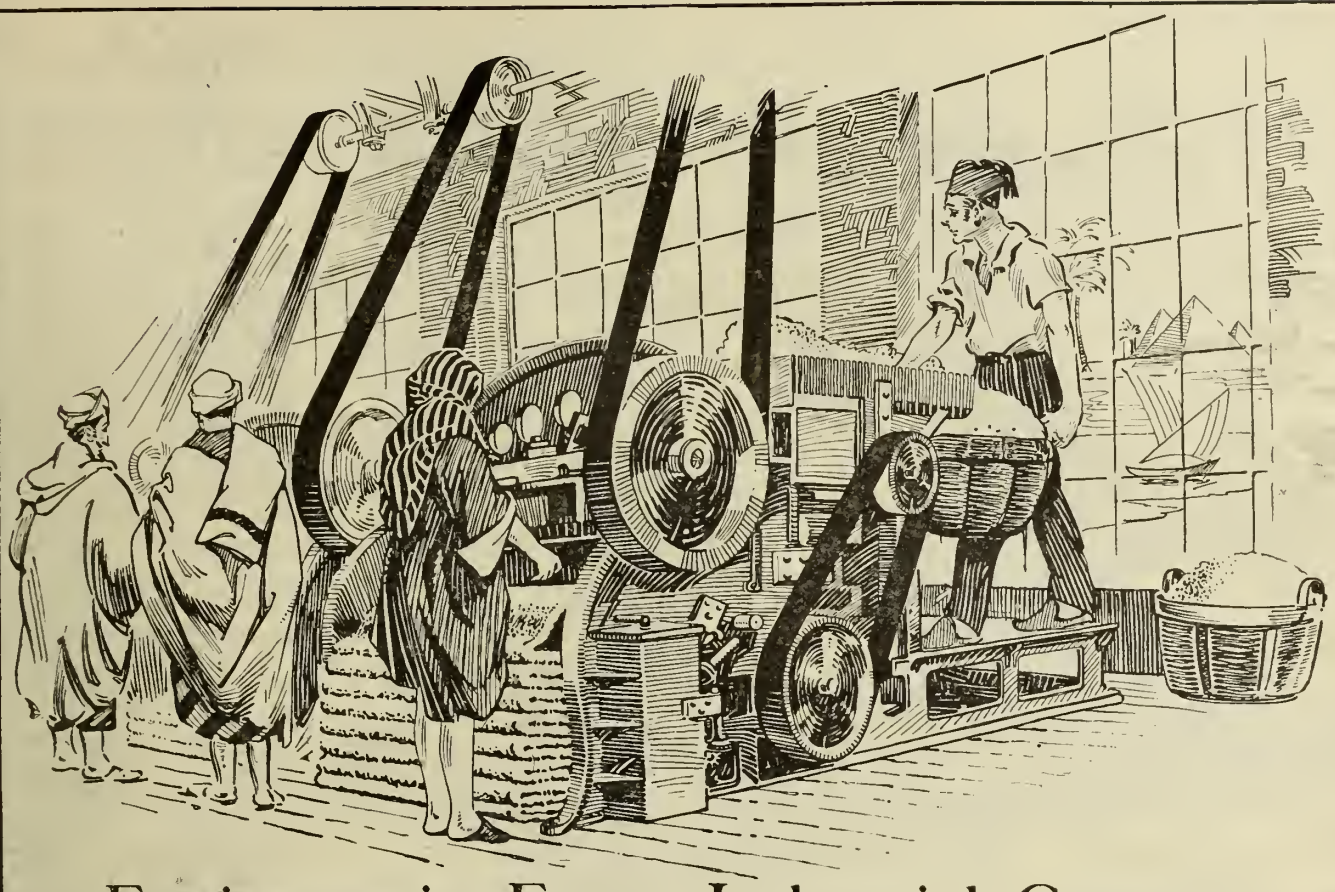
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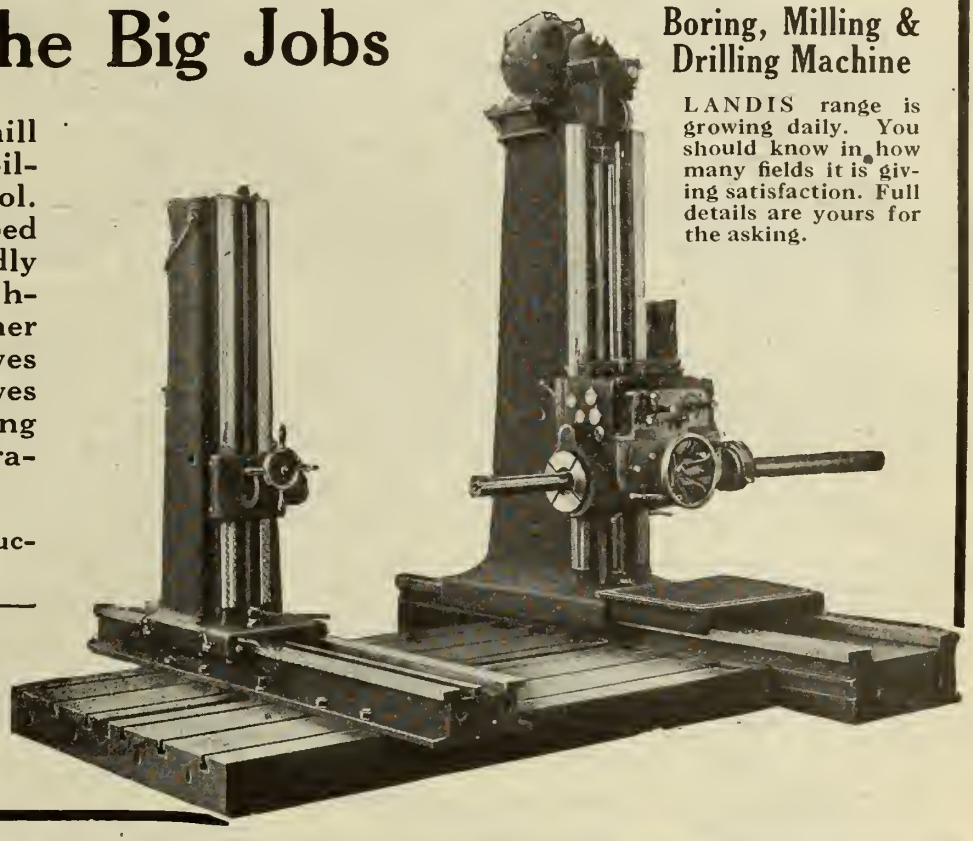
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MILLING MACHINES, PROFILE

Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

MILLING TOOLS

Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MINE CARS

Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dominion Bridge Co., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Pratt & Whitney Co., Dundas, Ont.

MINING MACHINERY

Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.
Holden Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MIXERS, SAND

Pettibone Mfg. Co., Chicago, Ill.

MORTISING CHAINS

Renold of Canada Ltd., Montreal.

MORTISING MACHINES

Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.

MOTORS, ELECTRIC

Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Sturtevant Co., B. F., Galt, Ont.
Volta Mfg. Co., Welland, Ont.
Williams Mach'y Co., A. R., Toronto.

MOTOR SPRINGS

The Dunbar Brothers Co., Bristol, Conn.

MOTORCYCLE FRAME AND FORK

The Dunbar Brothers Co., Bristol, Conn.

MOTORS, PNEUMATIC

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto.
Holden Co., Ltd., Montreal, Que.

MOULDS, RUBBER

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

MULTIPLE INDEX CENTRES

Garvin Machine Co., New York.
Graton & Knight Mfg. Co., Worcester, M.

MULTI-DRILLING, MULTI-BORING, MULTI-TAPPING MACHINERY,

Nat. Automatic Tool Co., Richmond, Ind.

MUNICIPALITIES

City of St. John, Quebec.

NAIL SETS

Morrow Screw & Nut Co., J., Ingersoll, Ont

NAME PLATES, BRONZE, ETCHED AND STAMPED

Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS

Can. Driver-Harris Co., Ltd., Walkerville.

NICKEL

Pilot Steel & Tool Co., Montreal, Que.

NICKEL STEEL

See Steel.

NICKEL SILVER—SHEETS, ROLLS, PLATES and RODS

Brown's Copper and Brass Rolling Mills, New Toronto.

NIPPLE THREADING MACHINES

Landis Machine Co., Waynesboro, Pa.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

NITROGEN

Carter Welding Co., Toronto, Ont.

NUTS, STEEL, CASTELLATED AND COLD PRESSED

Galt Machine Screw Co., Ltd., Galt, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Williams & Co., J. H., Brooklyn, N.Y.

NUTS, SEMI-FINISH AND FINISHED

Galt Machine Screw Co., Galt, Ont.
National-Acme Co., Cleveland, Ohio.
Wilkinson & Kompass, Hamilton.

NUT LOCKS

Edw. W. Robinson Co., Ltd., Montreal.

NUT BURRING AND NUT MACHINES (HOT)

National Machy. Co., Tiffin, Ohio.

NUT FACING AND BOLT SHAVING MACHINES

Garvin Machine Co., New York.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Victor Tool Co., Waynesboro, Pa.

NUT TAPPERS

Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

OILERS

All-Way Oiler Mfg. Co., Toronto, Ont.

OIL SEPARATORS

Can. Fairbanks-Morse Co., Montreal.

OIL STONES

Aikenhead Hardware Co., Toronto, Ont.
Carborundum Co., Niagara Falls, N.Y.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Norton Co., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

OIL STONE GRINDERS

Oliver Machy. Co., Grand Rapids, Mich

OIL STORAGE SYSTEMS

Bowser Co., Ltd., S. F., Toronto, Ont.

OPENING DIE HEADS

Greenfield Tap & Die Corp, Greenfield.
Wells Bros. of Canada, Galt, Ont.

ORE HANDLING EQUIPMENT

Brown Hoisting Machinery Co., Cleveland, Ohio.
Canadian Link-Belt Co., Ltd., Toronto, Ont.

OSCILLATING VALVE GRINDERS (PNEUMATIC)

Cleveland Pneumatic Tool Co. of Canada, Toronto.

OVENS FOR BAKING, BLUING, DRYING, ENAMELING, JAPANNING AND LACQUERING

Brantford Oven & Rack Co., Brantford

OVEN TRUCKS, STEEL

Brantford Oven & Rack Co., Brantford
MacKinnon Steel Co., Sherbrooke, Que.

OVENS FOR DRYING, TEMPER AND OXYGEN, ELECTROLYTIC CELLS UNDER TRUCKS

Brantford Oven & Rack Co., Brantford.

OXY-ACETYLENE WELDING AND CUTTING AND OUTFITS

Carter Welding Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
L'Air Liquide Society, Toronto, Ont.
Prest-o-Lite Co., Inc. Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.

OXYGEN

Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.
Nat. Electro Products Ltd., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.

OXYGEN PLANTS (ELECTROLYTIC)

Davis-Bournonville Co., Toronto, Ont.

PACKINGS, ASBESTOS

Cleveland Wire Spring Co., Cleveland.

PACKING, ROD AND SHEET

Dunlop Tire & Rubber Goods Co., Ltd. Toronto.
Goodyear Tire & Rubber Co., Can., Ltd. Toronto
Gutta Percha & Rubber, Ltd., Toronto.
International Mach. Spls., Ltd., Montreal
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co., Philadelphia, Pa

PANS, WET AND DRY

Frost Mfg. Co., Chicago, Ill.

PAPER MILL CONVEYORS AND DRIVES

Bertrams, Ltd., Edinburgh, Scotland.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Gutta Percha & Rubber, Ltd., Toronto.
MacKinnon Steel Co., Sherbrooke, Que.

PARTITIONS, WIRE

See Guards

PAPER MILL MACHINERY

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

PATTERN SHOP EQUIPMENT

Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Oliver Machy. Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.

PATTERN MAKERS' LATHES

See Lathes.

PATENT SOLICITORS

Fetherstonhaugh & Co., Ottawa.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.

PECK CARRIERS FOR POWER PLANTS

Can. Link-Belt Co., Toronto, Ont.

PENSTOCKS

William Hamilton Co., Peterboro, Ont.

PERFORATED METALS AND ORNAMENTAL IRON GOODS

Canada Wire & Iron Goods Co., Hamilton

PHOSPHOR TIN, COPPER AND BRONZE

British Smelting & Refining Co., Ltd., Montreal, Que.

PHOTOSTATS

Commercial Camera Co., Providence, R.I.

PIG IRON

Hanna & Co., M. A., Cleveland, O.
Steel Co. of Canada, Ltd., Hamilton, Ont.

PINS, TAPER

Morrow Screw & Nut Co., J., Ingersoll, Ont

PINS, BELT-LACING

Clipper Belt Lacer Co., Grand Rapids.

PIPE, BLACK & GALVANIZED

Crane, Ltd., Montreal, Que.

PIPE FITTINGS, MALLEABLE AND CAST IRON

International Malleable Iron Co., Guelph

PIPE CUTTING AND THREADING MACHINES

Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
McDougall Co., R., Galt.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Williams Machy. Co., A. R., Toronto
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

PIPE, JOINT COMPOUNDS

Crane, Ltd., Montreal, Que.

PIPE RIVETED STEEL

Toronto Iron Works, Ltd., Toronto.
William Hamilton Co., Peterboro, Ont.

PIERCING

Oliver Machy. Co., Grand Rapids, Mich

PIPE CUTTERS, ROLLING

Greenfield Tap & Die Corp., Greenfield
Wells Bros. Co. of Canada, Galt, Ont.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

PIPE TOOLS AND DIES

Ackworthie Ltd., J., Birmingham, Eng.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE CUTTERS AND REAMERS

Greenfield Tap & Die Corp., Greenfield.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. of Canada, Galt, Ont.

PIPE STOCKS AND THREADERS

Greenfield Tap & Die Corp., Greenfield.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. of Canada, Galt, Ont.

PIPE TAPS AND VISES

Ackworthie Ltd., J., Birmingham, Eng.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE WRENCHES

Greenfield Tap & Die Corp., Greenfield
Wells Bros. of Canada, Galt, Ont.

PISTON AND PISTON RING MACHINES

National Acme Co., Windsor, Vt.

PLANER BOLTS

Atkins & Co., E. C., Hamilton, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont

PLANER JACKS

Armstrong Bros. Tool Co., Chicago.

PLANERS, STANDARD AND ROTARY

Betts Machine Co., Rochester, N.Y.
Bertram & Sons Co., John, Dundas.
Oliver Machy. Co., Grand Rapids, Mich.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Gardner & Son, Robt., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Herbert Ltd., Alfred, Toronto, Ont.
Morton Mfg. Co., Muskegon Heights, Mich
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
Standard Equipment & Tool Wks., Montreal.

PLANING AND SHAPING MACHINERY

Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
Herbert, Ltd., Alfred, Toronto, Ont.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William, Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co. Ltd., A. R., Montreal

PLANER-SHAPER, COMBINED OPEN SIDE

Petrie, Ltd., H. W., Toronto.

PLANING MILL EXHAUSTERS

Can. Blower & Forge Co., Kitchener, Ont.
MacGovern & Co., Montreal, Que.
Niles-Bement-Pond Co., New York.
Sturtevant Co., B. F., Galt, Ont.

PLATES, Q.M., SHEARED AND CHEQUERED

Pechovers, Ltd., Toronto, Ont.

PLIERS

Aikenhead Hardware Co., Toronto.
Rice Lewis & Son, Toronto, Ont.

PNEUMATIC CYLINDERS

Holden Co., Ltd., Montreal, Que.

PNEUMATIC EQUIPMENT

Strelinger Co., C. A., Windsor, Ont.

PNEUMATIC TOOLS

Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland P'matic Tool Co., Can., Toronto.
Curtis Pneumatic Machy. Co., St. Louis.
Garlock-Walker Machy. Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Chicago.
Int. Mach. & Supply Co., Ltd., Montreal.
Strelinger, Chas. A. Co., Windsor, Ont.

POWER CRANES, HAND

MacKinnon Steel Co., Sherbrooke, Que.

POLISHING MACHINES

Ackworthie Ltd., J., Birmingham, Eng.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.

POLISHING PLATES

Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. of Canada, Galt, Ont.

POTS AND KETTLES, CAST STEEL

Elec. Steel & Metals, Welland, Ont.

POWER HOUSE CONVEYORS

Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

PORTABLE MACHINERY

Sheldon & Co., E. C., Chicago, Ill.

POWER TRANSMISSION MCHY.

Canadian Link-Belt Co., Ltd., Toronto.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Petrie, Ltd., H. W., Toronto.

PRECISION MACHINES

Herbert Ltd., Alfred, Toronto, Ont.

PRESSED STEEL PARTS

Ackworthie Ltd., J., Birmingham, Eng.

PRESSERS, ARBOR

Atlas Press Co., Kalamazoo, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
Lourie Manufacturing Co., Springfield, Ill.

PRESSES, BROACHING, FORGING AND FLANGING

Atlas Press Co., Kalamazoo, Mich.
Bliss Co., E. W., Brooklyn, N.Y.
Dom. Steel Products Co., Ltd., Brantford.
Eastern Production Co., Detroit, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, CAM, TOGGLE, EYELET

Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn N.Y.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.

PRESSES, FILTER

Perrin, Ltd., William R., Toronto.

PRESSES, PNEUMATIC

Dom. Steel Products Co., Ltd., Brantford.
Eastern Production Co., Detroit, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Toledo Machine & Tool Co., Toledo.

PRESSES, DROP AND FORGING

Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co, Toledo.

PRESSES, HYDRAULIC

Bertram & Sons Co., John, Dundas.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke.
Dom. Steel Products Co., Ltd., Brantford.
Eastern Production Co., Detroit, Mich.
Lourie Manufacturing Co., Springfield, Ill.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Williams Machy. Co., A. R., Toronto.

PRESSES, HYDRAULIC, HORIZONTAL

Eastern Production Co., Detroit, Mich.

PRESSES, HYDRAULIC, VERTICAL

Eastern Production Co., Detroit, Mich.

PRESSES, HYDRO-PNEUMATIC

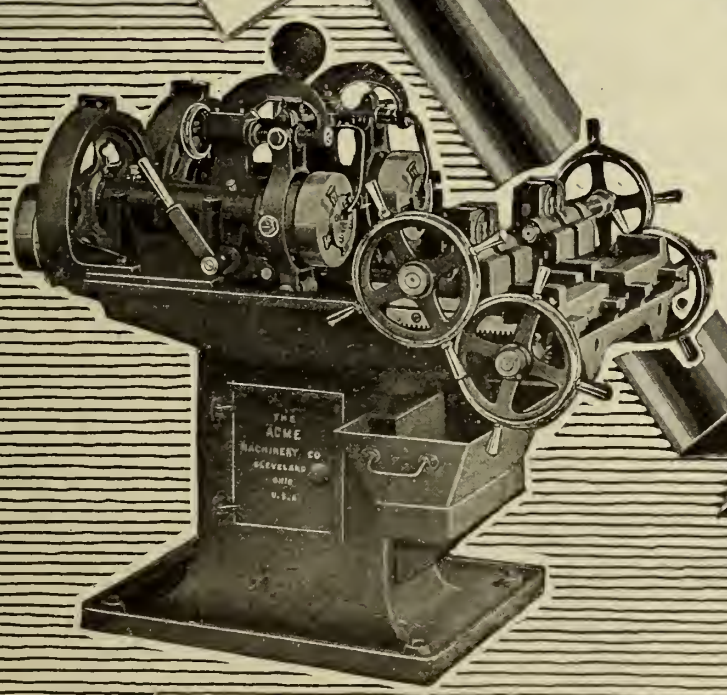
Eastern Production Co., Detroit, Mich.

PRESSES, BALING

Perrin, Ltd., William R., Toronto.

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Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy. Co., A. R., Toronto.

PRESSES, SPRING FOOT
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, SCREW
Bliss Co., E. W., Brooklyn, N.Y.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.

PRESSES, TIRE
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

PRESSES, TRIMMING
Bliss Co., E. W., Brooklyn, N.Y.
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.

PROFILING MACHINES
Herbert Ltd., Alfred, Toronto, Ont.

PROJECTORS, FLOOD LIGHTING
Holden Co., Ltd., Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que

PROPELLERS
Kennedy & Sons, Wm., Owen Sound.

PROTECTIVE COATINGS
H. H. Robertson, Ltd., Sarnia, Ont.

PSYCROMETERS, SLING
Taylor Instrument Co., Rochester, N.Y.

PULLEYS
Algoma Steel Corp., Sault Ste. Marie, Ont
American Pulley Co., Philadelphia.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., Fortierville, Que.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Diamond State Fibre Co., Bridgeport, Pa.
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Kennedy & Sons, Ltd., W., Owen Sound.
Positive Clutch & Pulley Works Ltd., Toronto.
Petrie, Ltd., H. W., Toronto.

PULLEYS, STEEL SASH, STEEL BELT
American Pulley Co., Philadelphia, Pa.

PULLEYS, FRICTION, CLUTCH
American Pulley Co., Philadelphia, Pa.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mch. Co., Manchester, Ct.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Jones & Glasco, Montreal.
Positive Clutch & Pulley Works, Toronto.
Petrie, Ltd., H. W., Toronto.

PULP MILL MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

PUMPS, AIR LIFT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Holden Co., Ltd., Montreal, Que.

PUMPS, BOILER FEED
Can. Ingersoll-Rand Co., Ltd. Sherbrooke,

PUMPS, CENTRIFUGAL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Darling Bros., Ltd., Montreal, Que.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, FUEL OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Darling Bros., Ltd., Montreal, Que.
Trabern Pump Co., Rockford, Ill.

PUMPS, GEARED
Darling Bros., Ltd., Montreal, Que.
Globe Engineering Co., Hamilton, Ont.

PUMPS, HIGH PRESSURE
Perrin, Ltd., William R., Toronto.

PUMPS, HYDRAULIC
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Clarke & Co., Furnias, Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Darling Bros., Ltd., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, RETURN AIR
Can. Ingersoll-Rand Co. Ltd., Sherbrooke,

PUMPS, SPECIAL
Elec. Steel & Metals, Welland, Ont.

PUMPS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, KEROSENE, OIL, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, LUBRICANT, OIL, WATER
Darling Bros., Ltd., Montreal, Que.
Trabern Pump Co., Rockford, Ill.

PUMPS — ROTARY
General Combustion Co., Ltd., Montreal, Que.

PUMP LEATHERS
Graton & Knight Mfg. Co., Worcester.

PUNCHES AND DIES
Atkins & Co., Ltd., Wm., Sheffield, Eng.
E. W. Bliss Co, Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Can.
Can. Blower & Forge Co., Kitchener, Ont.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Gardner & Son, Robert, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Marshall, Son & Blunney, Toronto.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHES, POWER
John Bertram & Sons Co., Dundas, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd, Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Buffalo, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams, Ltd., Edinburgh, Scotland.
Bertrams & Sons, John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton, Ont.
Garlock-Walker Mach'y. Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHES, HAND
Niles-Bement-Pond Co., New York.

PYROMETERS
Bristol Co., Waterbury, Conn.
Shore Instrument & Mfg. Co., New York
Taylor Instrument Co., Rochester, N.Y.

QUARTERING MACHINES
Bertram & Sons, John, Dundas, Ont.
Niles-Bement-Pond Co., New York.

RAIL BENDERS
Algoma Steel Corp., Sault Ste. Marie, Ont.

RAILROAD TOOLS
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

RASPS
Atkins & Co., Ltd., Wm., Sheffield, Eng
Marshall, Son & Bunney, Toronto.

RAWHIDE PINIONS (See Gears)

REAMERS
Butterfield & Co., Inc., Rock Island, Que.

REAMERS, ADJUSTABLE
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.
J. A. M. Taylor, 318 Stair Bldg., Toronto
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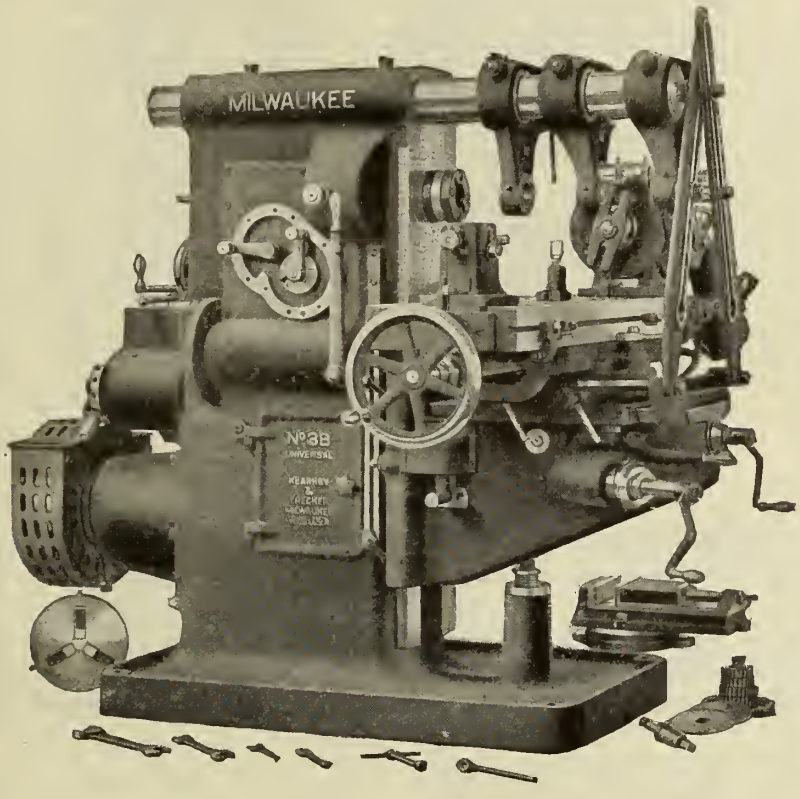
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Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
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Firth & Sons, Thos., Montreal, Que.
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont.
Latrobe Electric Steel Co., Latrobe, Pa.
Pilot Steel & Tool Co., Montreal, Que.
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Dominion Foundries & Steel Ltd., Hamilton, Ont.
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Rice Lewis & Son, Toronto, Ont.
Wells Bros., Co., of Canada, Galt, Ont.

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Bertrams, Ltd., Edinburgh, Scotland.

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Dom. Steel Products Co., Ltd., Brantford.
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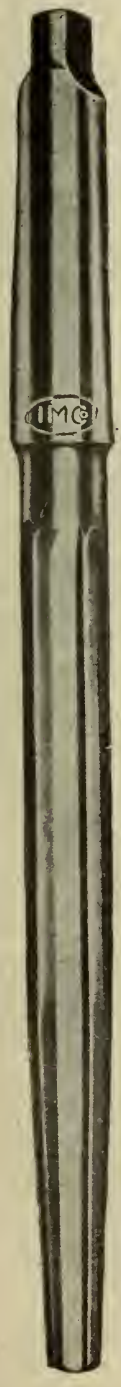
SURFACE PLATES
Brown & Sharpe Mfg. Co., Providence, R.I.

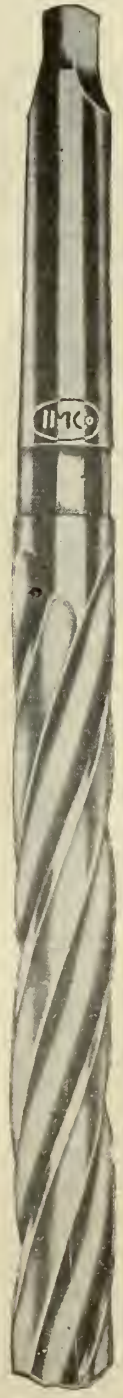
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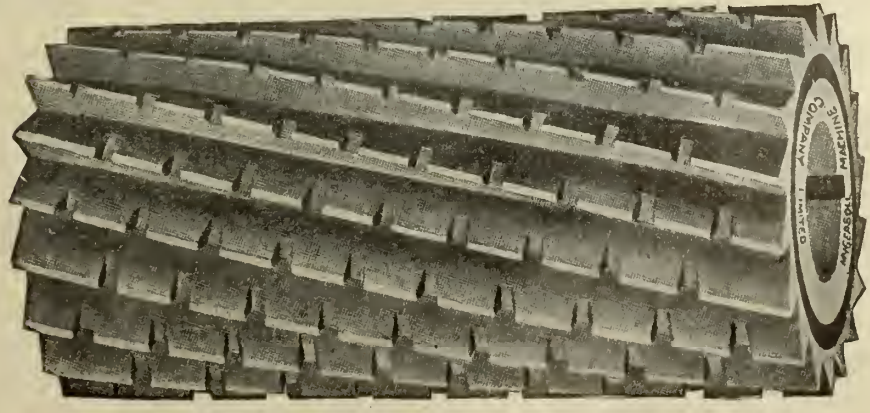
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MacGovern & Co., Montreal, Que.
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Toronto Iron Works, Ltd., Toronto.

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Toronto Iron Works, Ltd., Toronto.

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Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

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Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
William Hamilton Co., Peterboro, Ont.

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Rice Lewis & Son, Toronto, Ont.

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A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Murchy Machine & Tool Co., Detroit.
Niles-Bement-Pond Co., New York.
National-Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
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Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Pilot Steel & Tool Co., Montreal, Que.
Victor Tool Co., Waynesboro, Pa.

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TAPS, MACHINE RELIEVED
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Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

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Greenfield Tap & Die Corp., Greenfield, Mass.
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Greenfield Tap & Die Corp., Greenfield.
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Marshall, Son & Bunney, Toronto.
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Wells Bros. of Canada, Galt, Ont.

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Foss Mchy. & Sply. Co., G. F., Montreal.
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Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
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Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
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Rice Lewis & Son, Toronto, Ont.
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Taylor Instrument Co., Rochester, N.Y.

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Shore Instrument & Mfg. Co., New York

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Oliver Machy. Co., Grand Rapids, Mich

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Toronto Testing Laboratory, Toronto.

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Geometric Tool Co., New Haven.
Jardine & Co., Ltd., A. B., Hespeler.
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National-Acme Co., Cleveland, Ohio.
National Machy. Co., Tiffin, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt., Ont.

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Landis Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

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Hoyt Metal Co., Toronto, Ont.

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Petrie, Ltd., H. W., Toronto.

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Perrin, Ltd., William R., Toronto.

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Cleveland Twist Drill Co., Cleveland.
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Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

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Independent Pneumatic Tool Co., Chicago
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Williams Machy. Co., A. R., Toronto.
U. S. Electrical Tool Co., Cincinnati, O

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Deloro Smelting & Refining Co., Ltd Toronto, Ont.

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Williams & Co., J. H., Brooklyn, N.Y.

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Strelinger Co., C. A., Windsor, Ont.

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McClean Machine & Tool Co., Ltd., Hamilton, Ont.
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Northern Electric Co., Ltd., Montreal.

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Kennedy & Sons, Wm., Owen Sound, Ont
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Renold of Canada Ltd., Montreal.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto.

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MacKinnon Steel Co., Ltd., Sherbrooke

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Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Northern Crane Works, Walkerville.
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Steinle Turret Mach. Co., Madison, Wis
Strelinger, Chas. A. Co., Windsor, Ont.
Warner & Swasey Co., The, Cleveland, O

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London Bolt & Hinge Wks., London, Ont.
Marshall, Son & Bunney, Toronto.
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Steel Co. of Canada, Ltd., Hamilton, Ont.

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Gear Cutting With the "IFS" Left Out

The Gear Shaper Way

A production manufacturer knows that he will secure good gears IF he has an accurate cutter, an accurate machine and a machine working on the correct principle. The whole question of good gears is resolved in this one little word "IF."

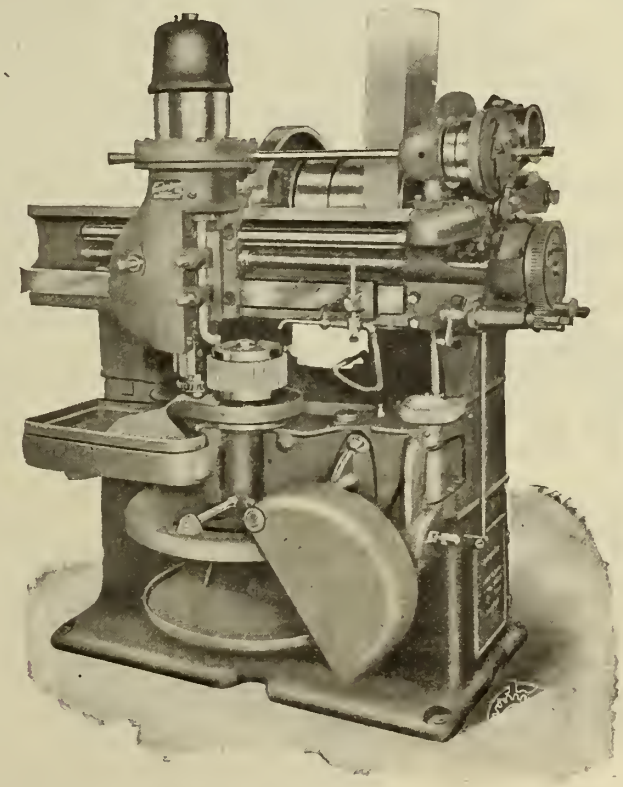
When the Gear Shaper was originally designed, the question of "IF" was taken into consideration and every possible means known to mechanical engineering was employed to eliminate the "IFS" from gear cutting.

That we have been successful in solving the problem is evidenced by the fact that each ensuing year sees a larger number of manufacturers adopting the Gear Shaper method.

How the Gear Shaper has accomplished this is clearly explained in our general catalog "Commercial Gear Cutting," which is a treatise on the subject of:—

Gear Cutting with the "IFS" Left Out.

Send for your copy to-day.



The Fellows Gear Shaper—the machine which has taken the "IFS" out of gear cutting.

The Fellows Gear Shaper Company

Springfield, Vermont, U.S.A.

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L'Air Liquide Society, Toronto, Ont.
Willson Goggles Inc., Reading, Pa.

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L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

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Davis-Bournonville Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co. of Canada, Limited, Toronto, Ont.
Nat. Electro Products Ltd., Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Union Carbide Co. of Can. Ltd., Welland, Ont.

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Lyman Tube & Supply Co., Montreal, Que

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Petrie, Ltd., H. W., Toronto.

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Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont.

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Hamilton Co., Ltd., Wm., Peterborough, Ont.
Kennedy & Son, Wm., Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

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Hamilton Co., Ltd., Wm., Peterborough, Ont.

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Brown, Boggs Co., Ltd., Hamilton, Can.

WIRE GUARDS
Can. Wire & Iron Goods Co., Hamilton, Ont.

WIRE NAILS
Parmenter & Bulloch Co., Gananoque.
Steel Co. of Canada, Ltd., Hamilton, Ont

WIRE ROPE
B. Greening Wire Co. Hamilton, Ont.
Can. Wire & Iron Goods Co., Hamilton, Ont.
Samuel Osborne, Ltd., Montreal, P.Q.

WIRE NAIL MACHINERY
National Machy. Co., Tiffin, Ohio.

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Can. Driver-Harris Co., Ltd., Walkerville.

WIRE STEEL, BRASS, COPPER
Steel Co. of Canada, Ltd., Hamilton, On.

WIRE, WEAVING, MONEL METAL, BRASS, COPPER, GOLDEN BRONZE, HIGH BRASS, LOW BRASS, NICKEL
Can. Driver-Harris Co., Ltd., Walkerville.

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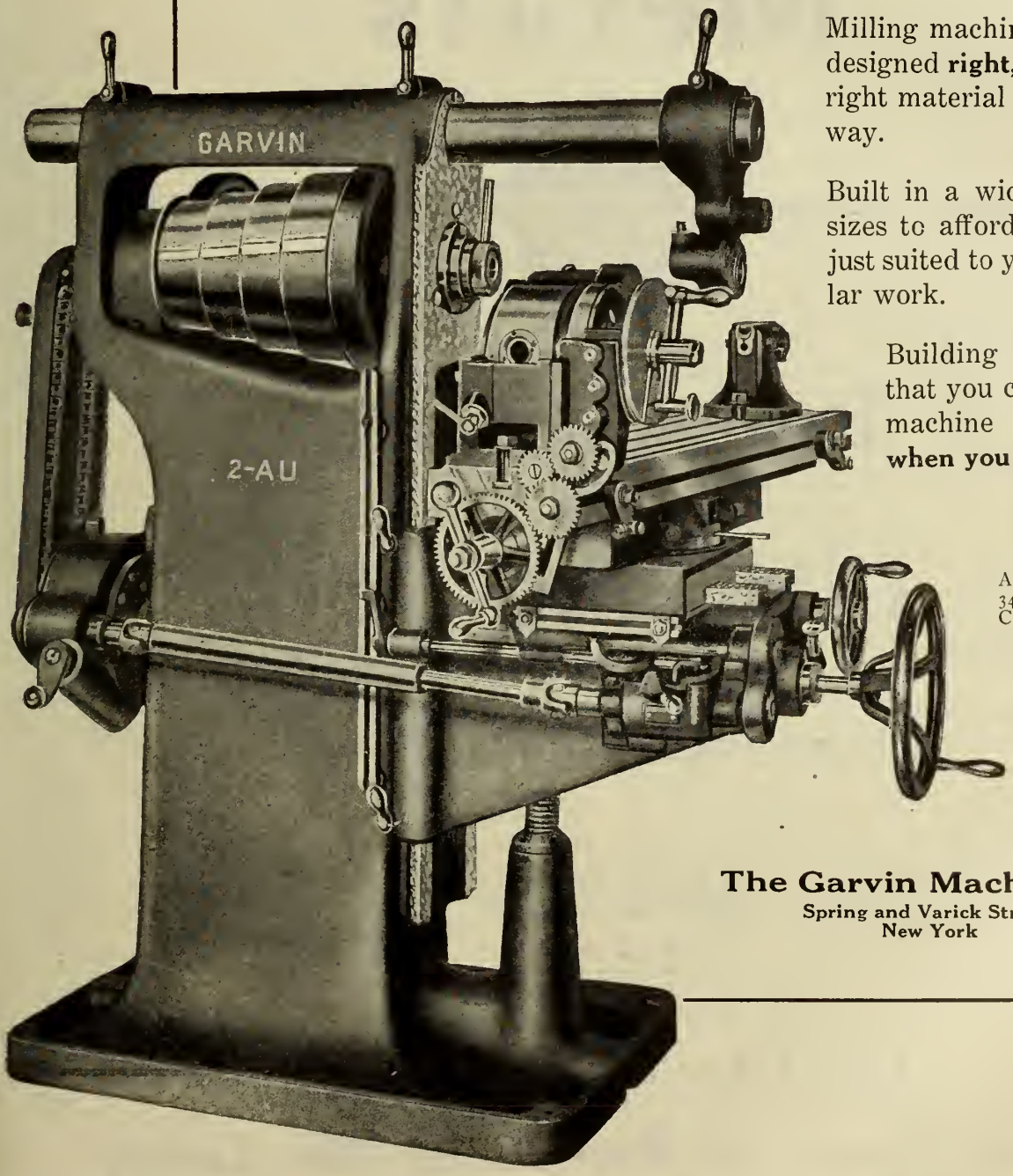
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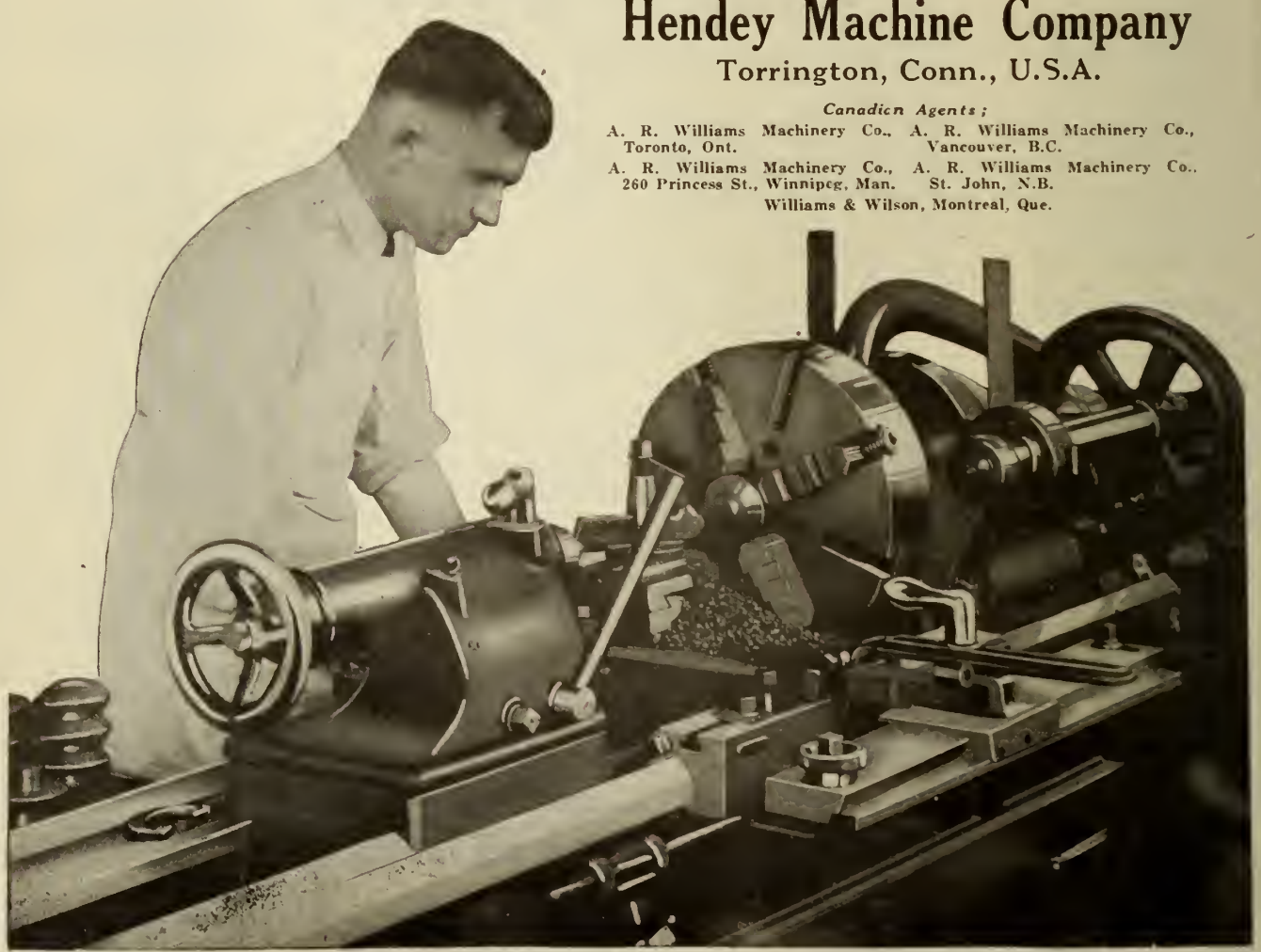
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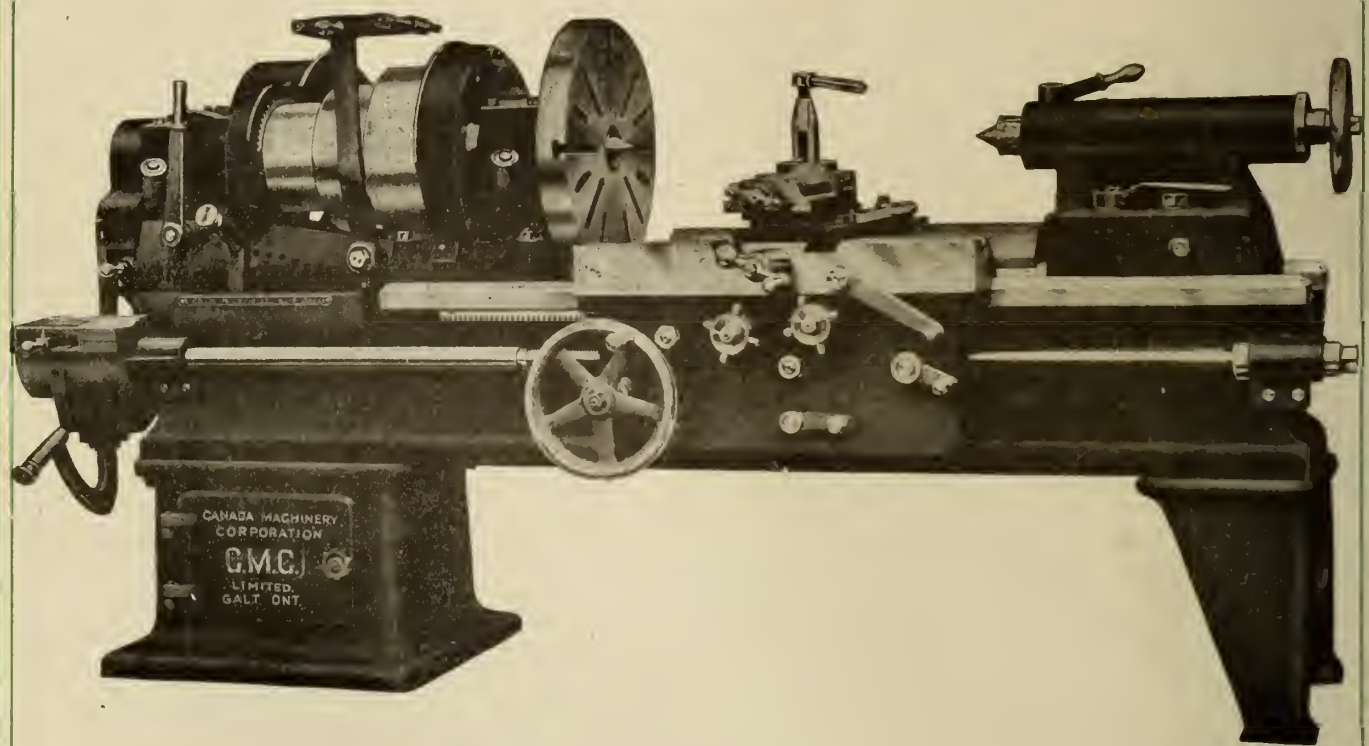
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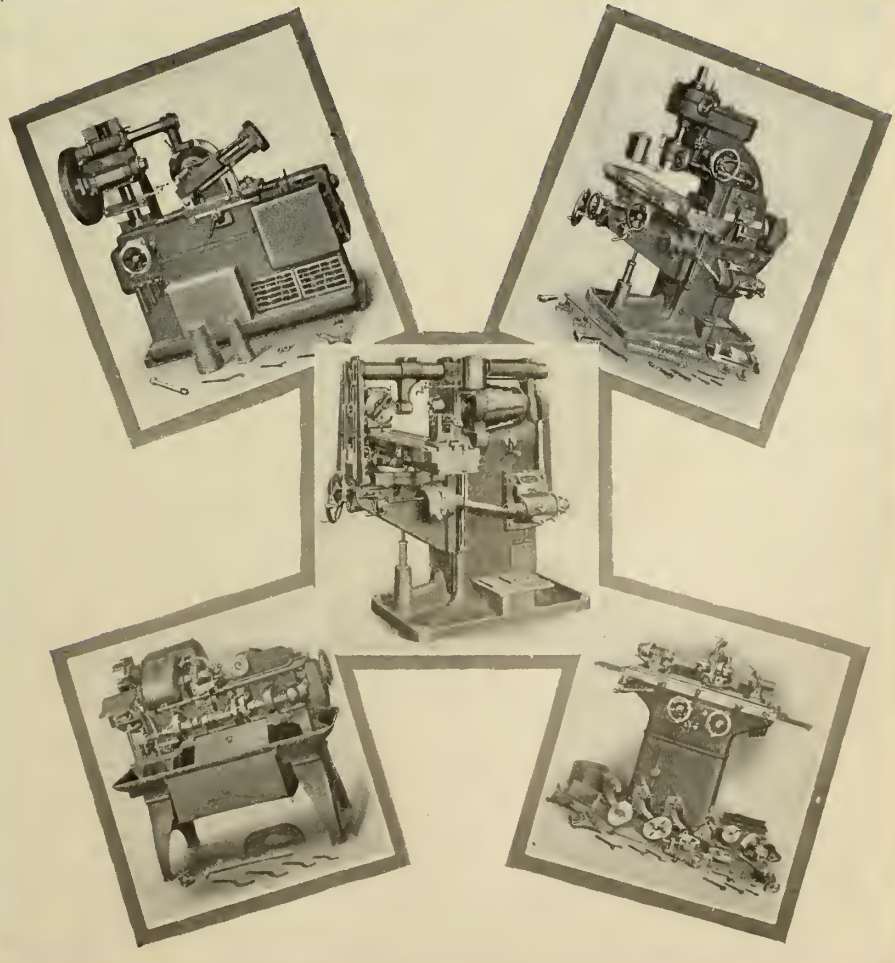
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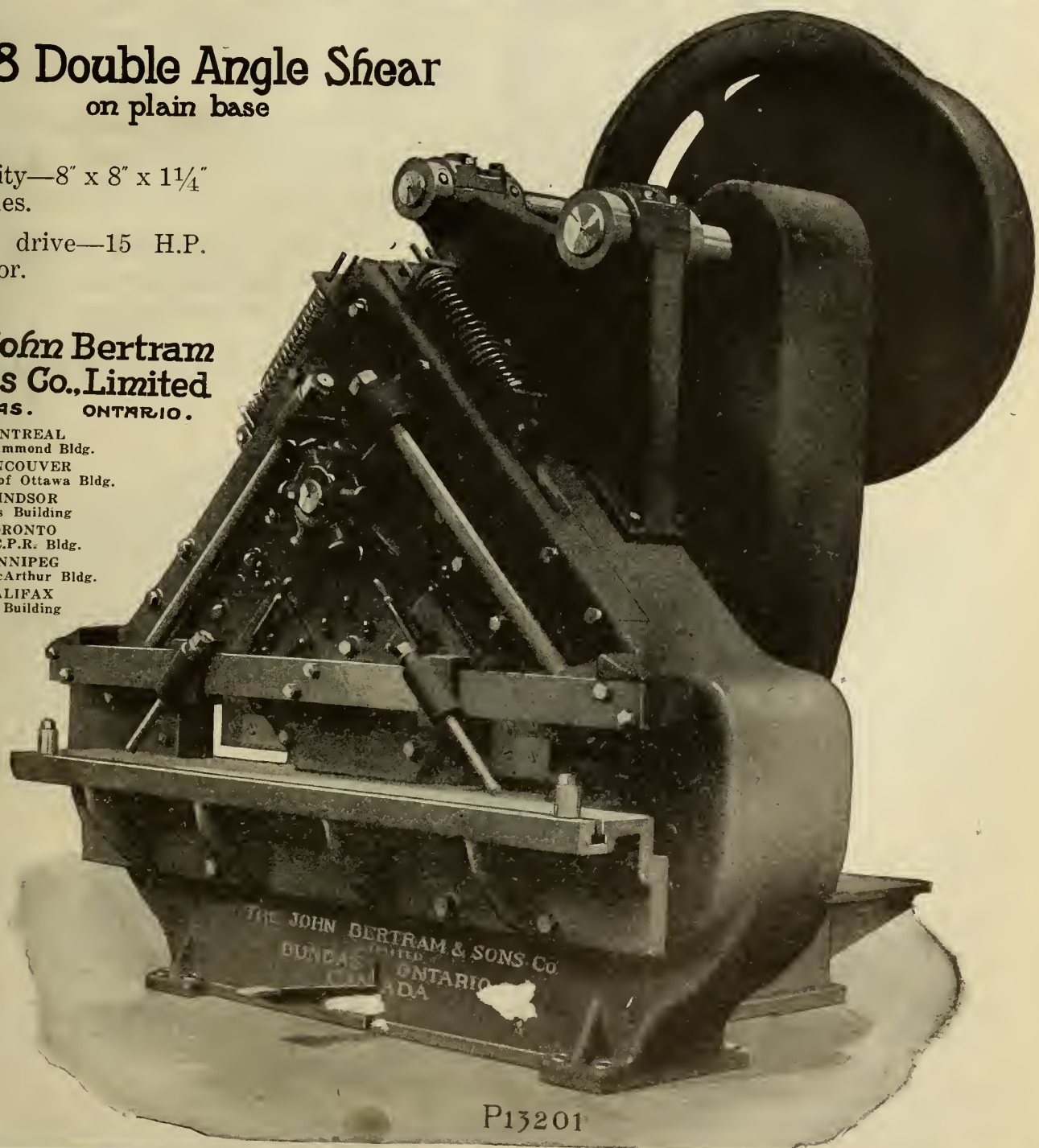
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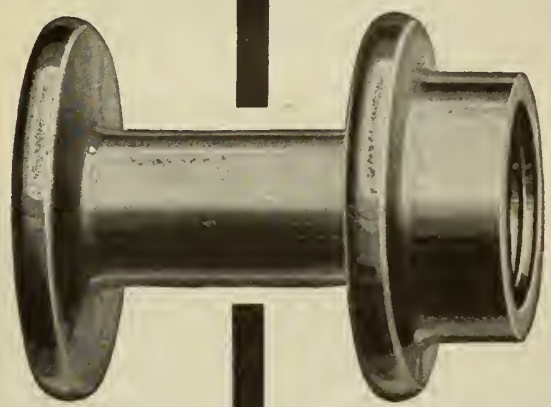


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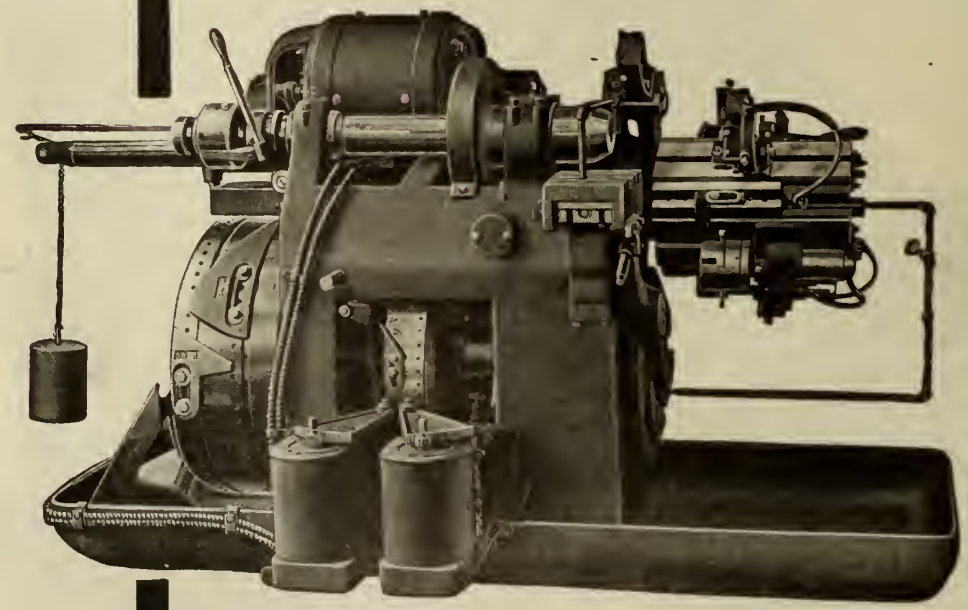


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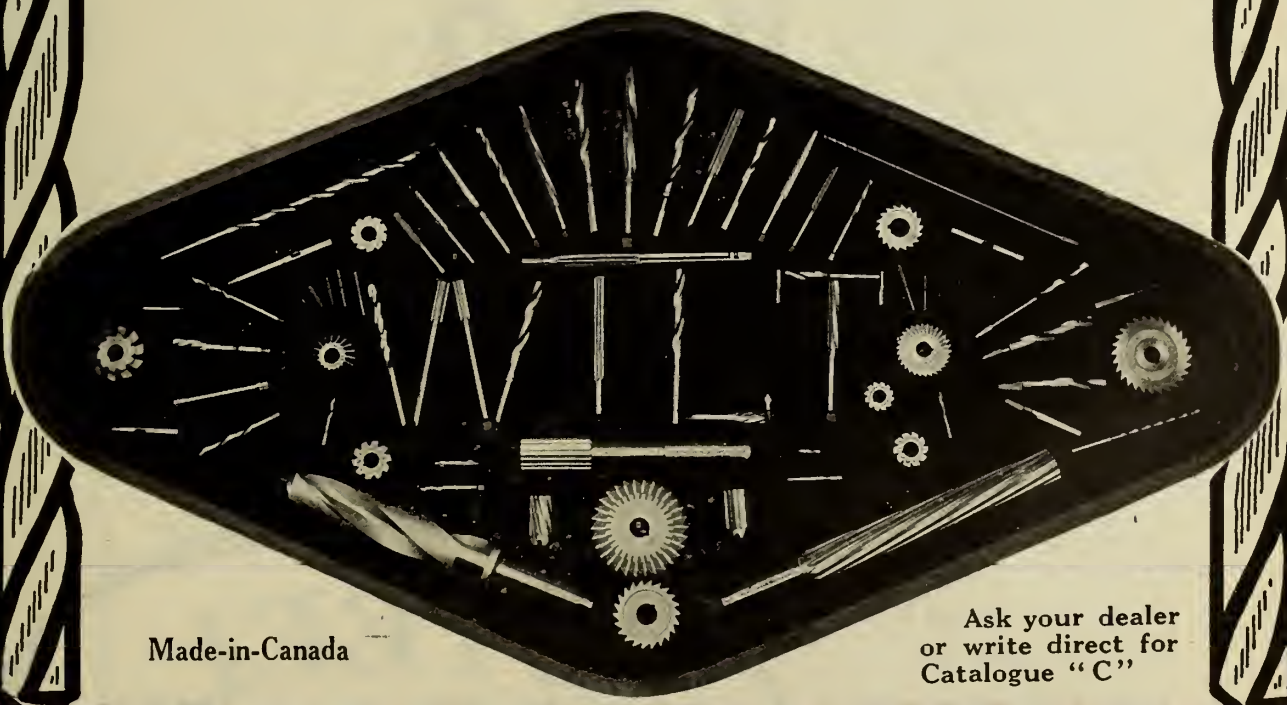
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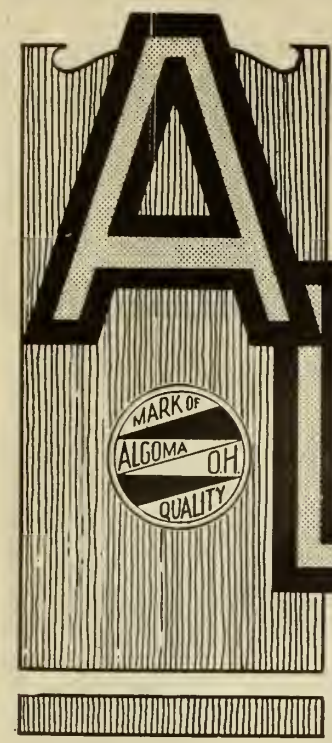


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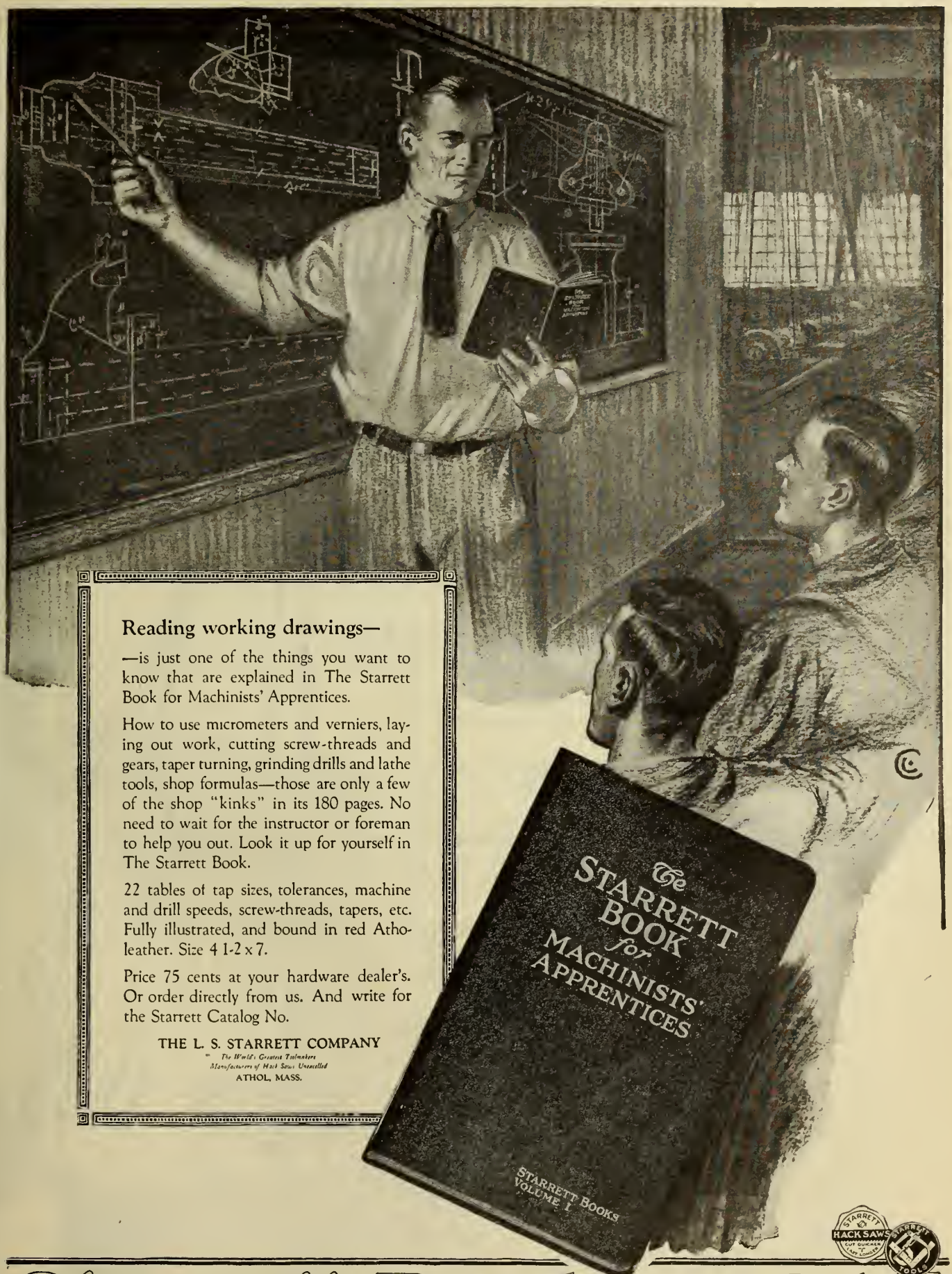
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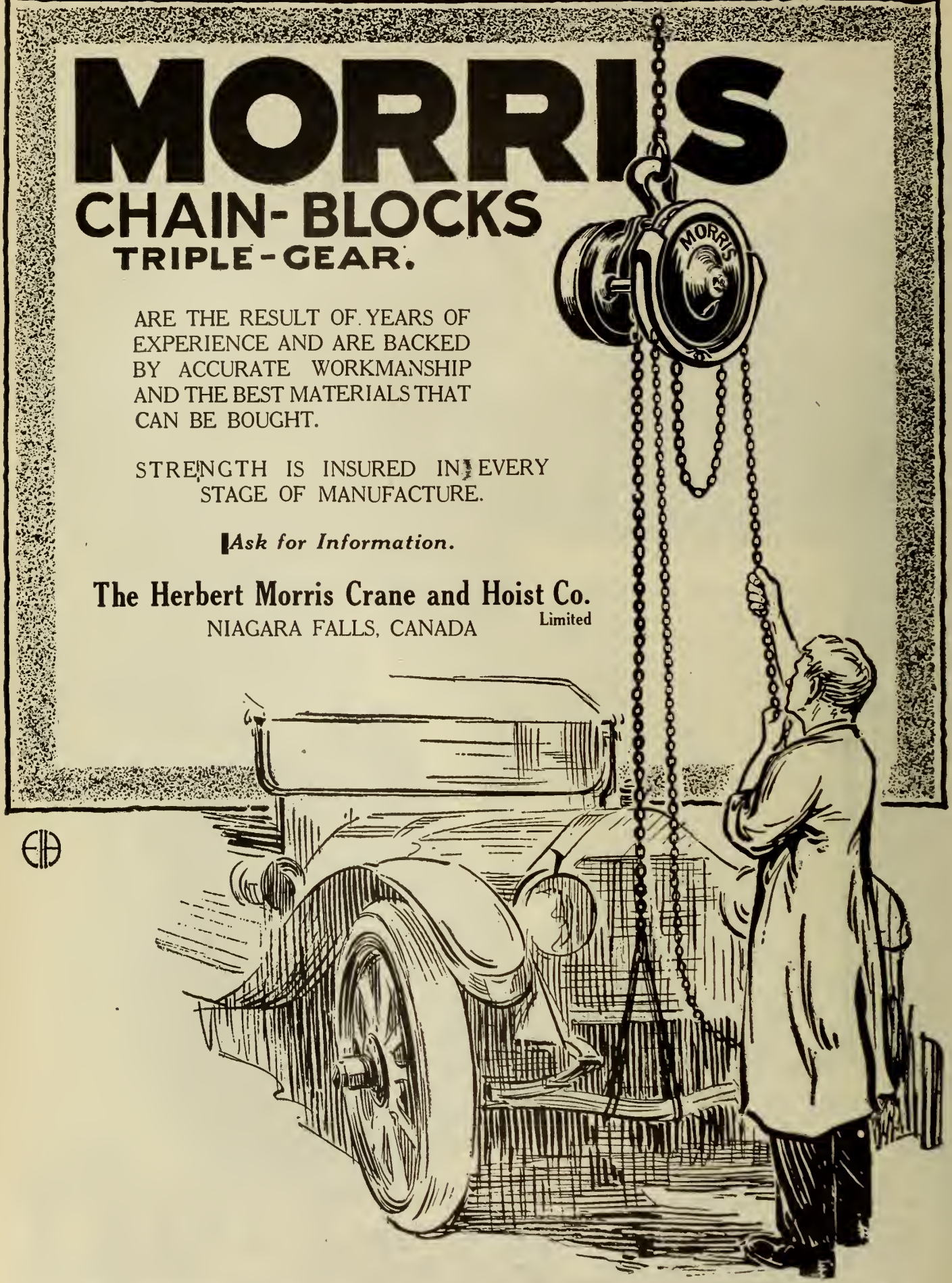
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Universal Edge - up to 40 in. wide

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Any Thickness **Any Lengths**

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HARTNESS AUTOMATIC DIES

FOR REVOLVING SPINDLES

The No. 4 Type R Hartness Automatic Die has been designed for use on revolving spindles, either Vertical or Horizontal.

THREE TYPES OF CONTROLS

Outside button coming into contact with some set stop on the machine.

Regular knock-off by carriage coming to a stop while chasers, which are carried along by the revolving thread, pull the body away from the latch pin.

Sleeve control enable chasers to be released or locked at any time.

The Hartness Automatic Dies are the only automatic dies made that will, without the aid of lead screws, cut threads rivaling in lead accuracy those cut by the best engine lathes.

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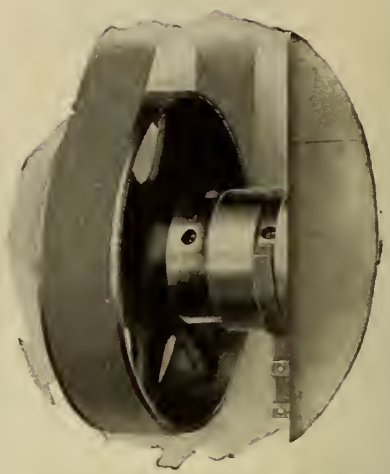
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Put Johnson Clutches on Your Machines

The tight and loose pulley is passing from favor. With all its disadvantages, it long survived because a reliable friction clutch was not in evidence.

But in the Johnson Clutch, builders of high grade machinery have found real clutch service. It has been thoroughly tested and adopted on the finest machines made.

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Single Clutch Pulley with Pulley Mounted.

Write for our Yellow Catalog, and Booklet, "Clutches As Applied To Machine Building."

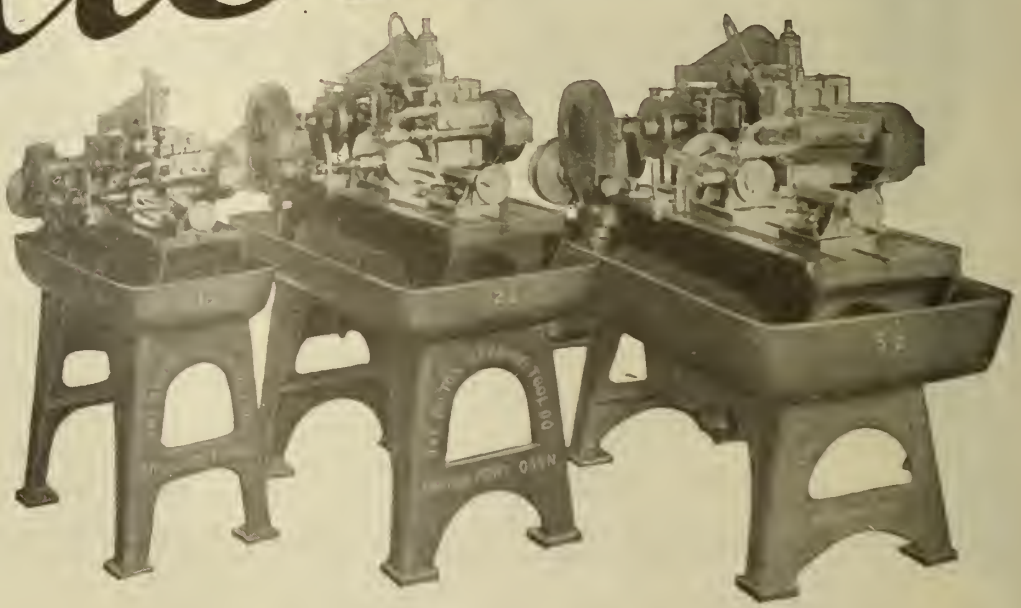
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Their adaptability is almost unlimited on small work—such as cutting spur, bevel, miter, angle gears, saws, ratchets, sprockets, cutters, knurls; taps, cylinders, form cutting, manufacturing, milling, etc.

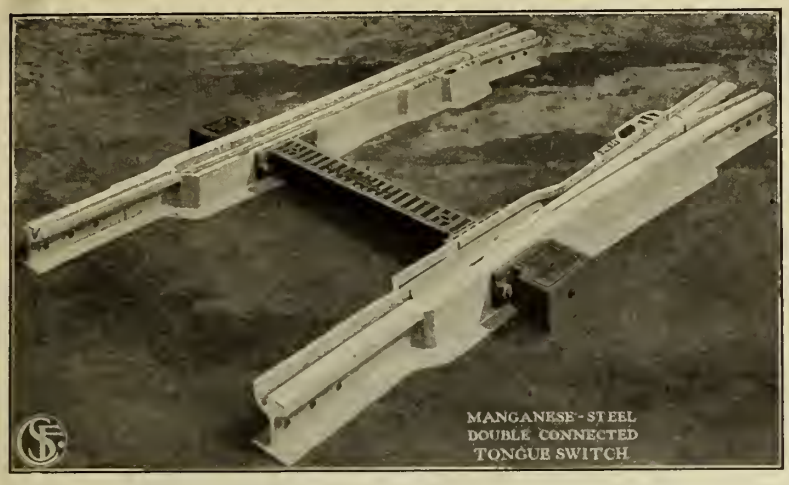
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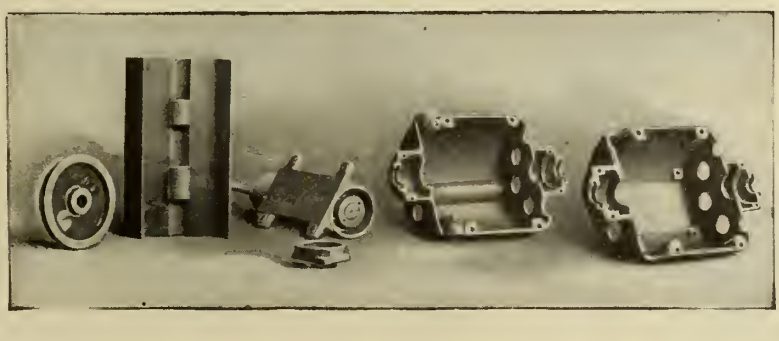
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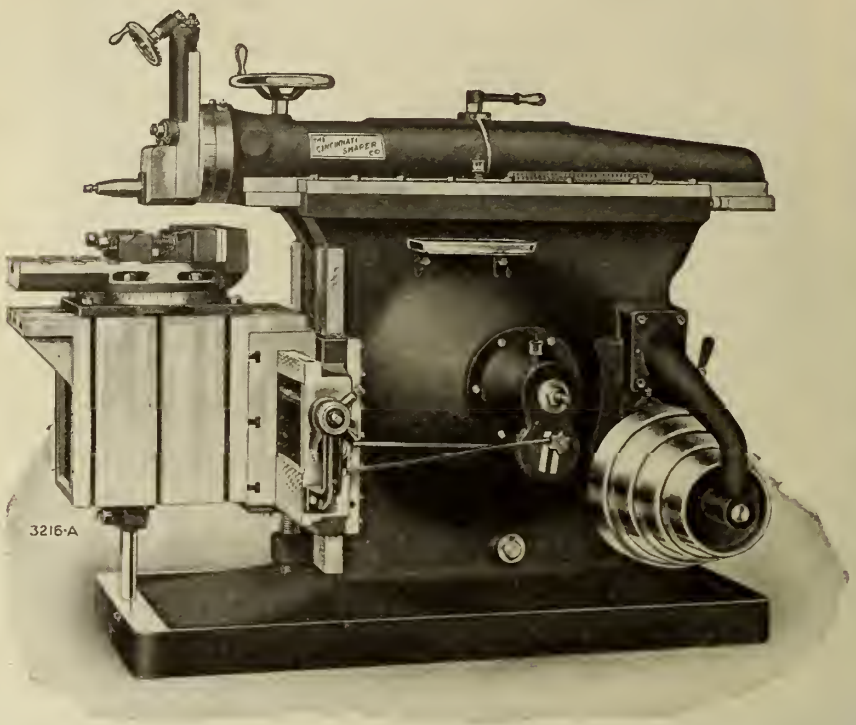
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THIS Machine will turn the work out faster, finish it more accurately, and lower the cost of production.

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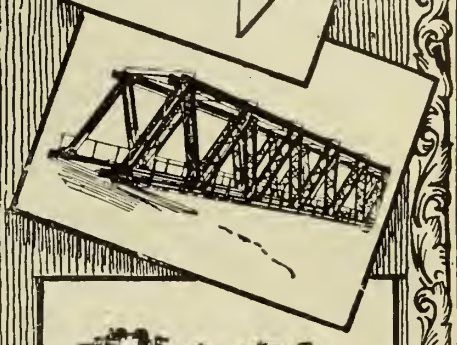
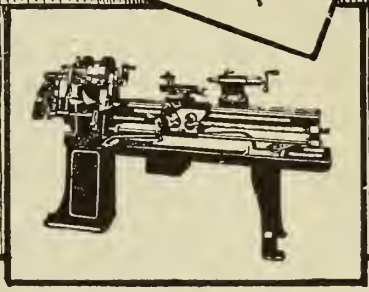
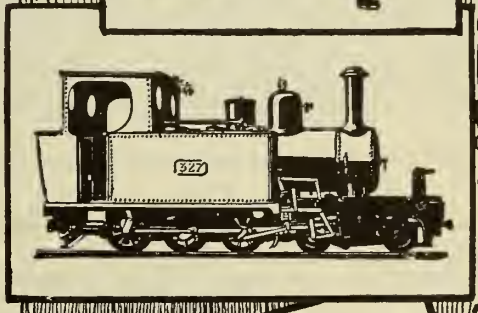
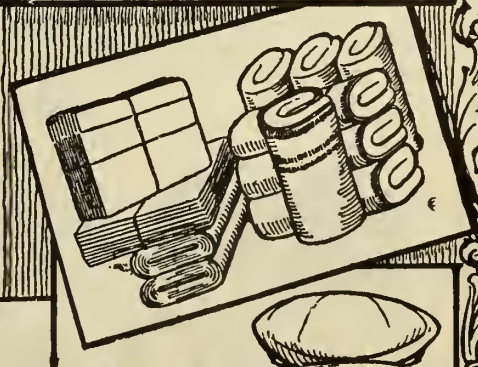
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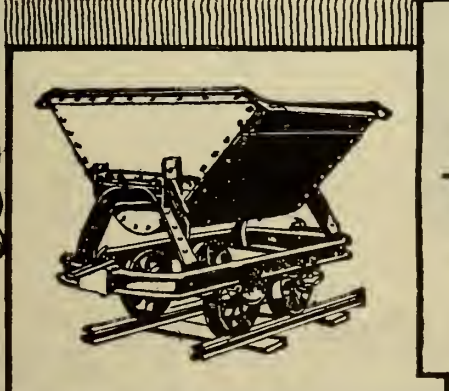
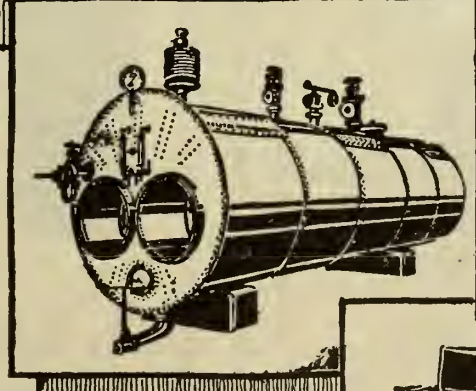
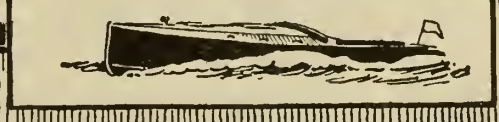
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The consumption of mineral oil products is increasing faster than the production. Consequently engineers are beginning to realize how important and necessary it is to conserve these oils.

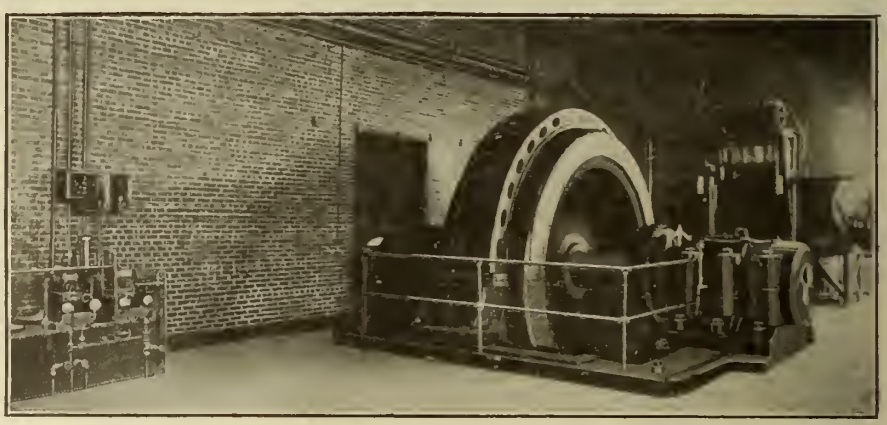
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By filtering oil with a Bowser system it can be used over and over again — or indefinitely. The installation of a Bowser Complete Oil Filtering and Calculating System generally results in a saving of over 50 per cent. on your oil bill.

The picture on the right shows a practical application of a Bowser 6-F Oil Filtering and Circulating System. It can be used with engines and other machinery where the filtration of dirty oil is essential.

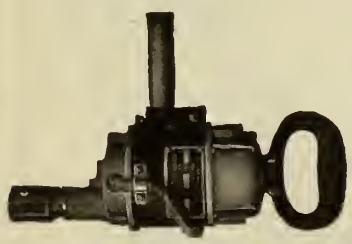
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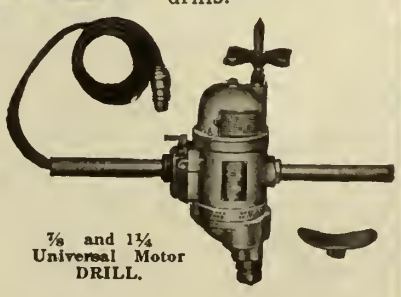
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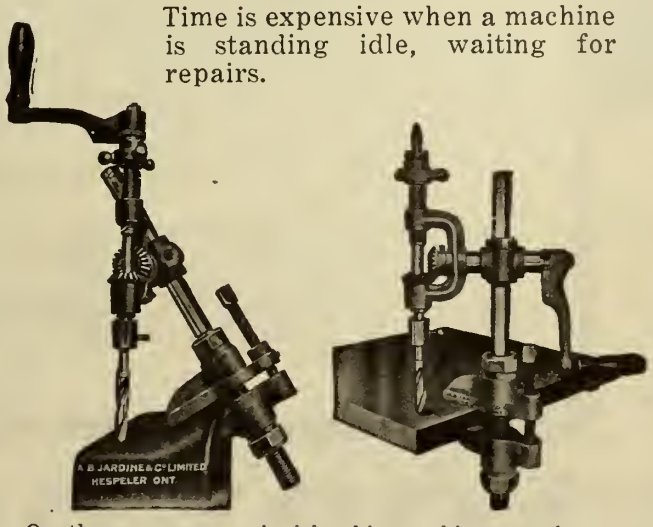
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1856

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New York Office 217 Broadway

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Jardine Universal Ratchet Drill

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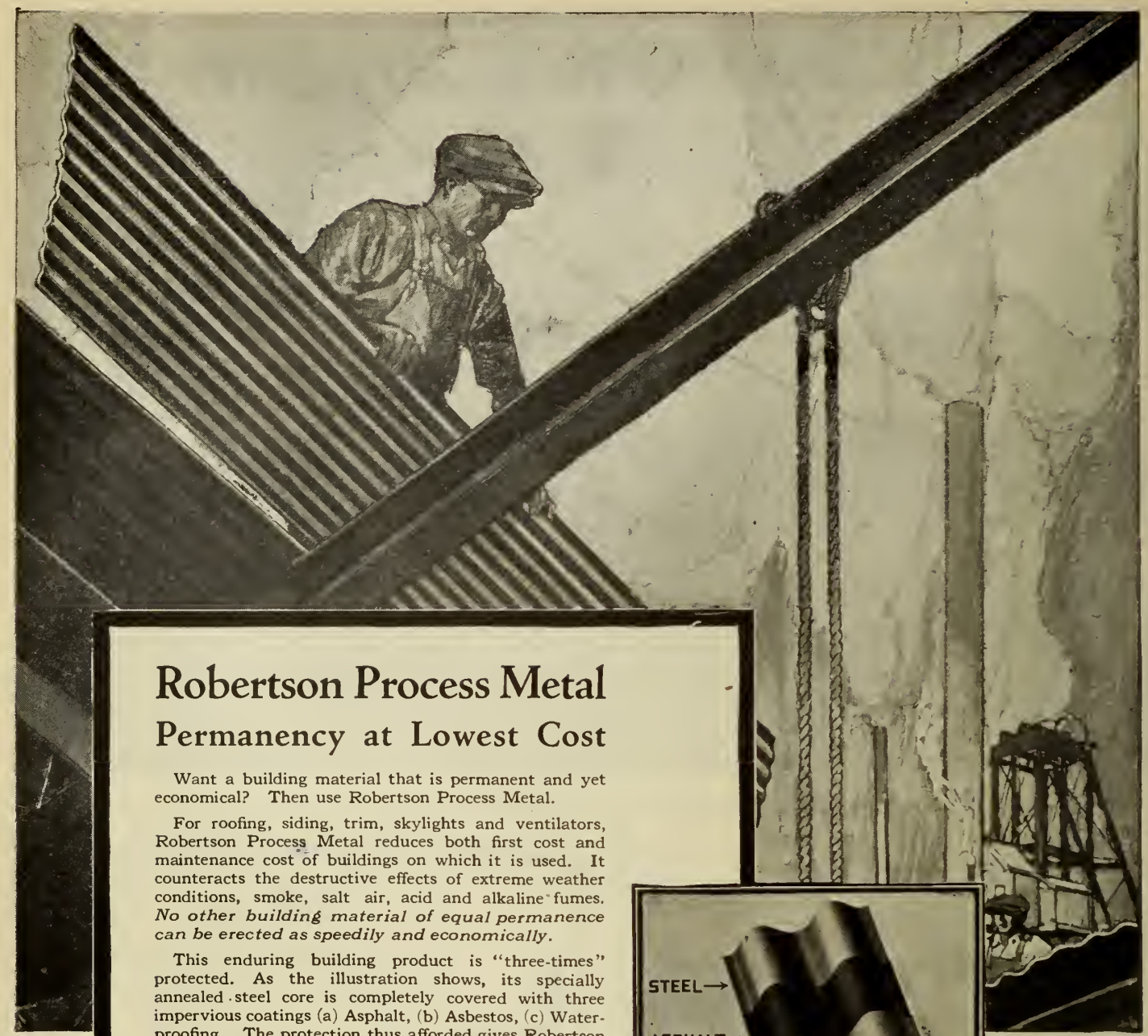


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Let us send you sample, together with interesting descriptive literature.



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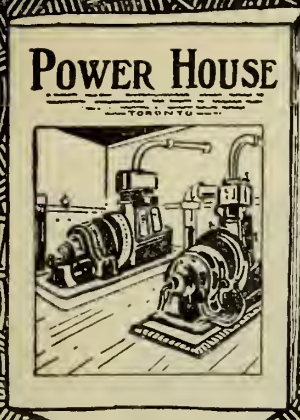
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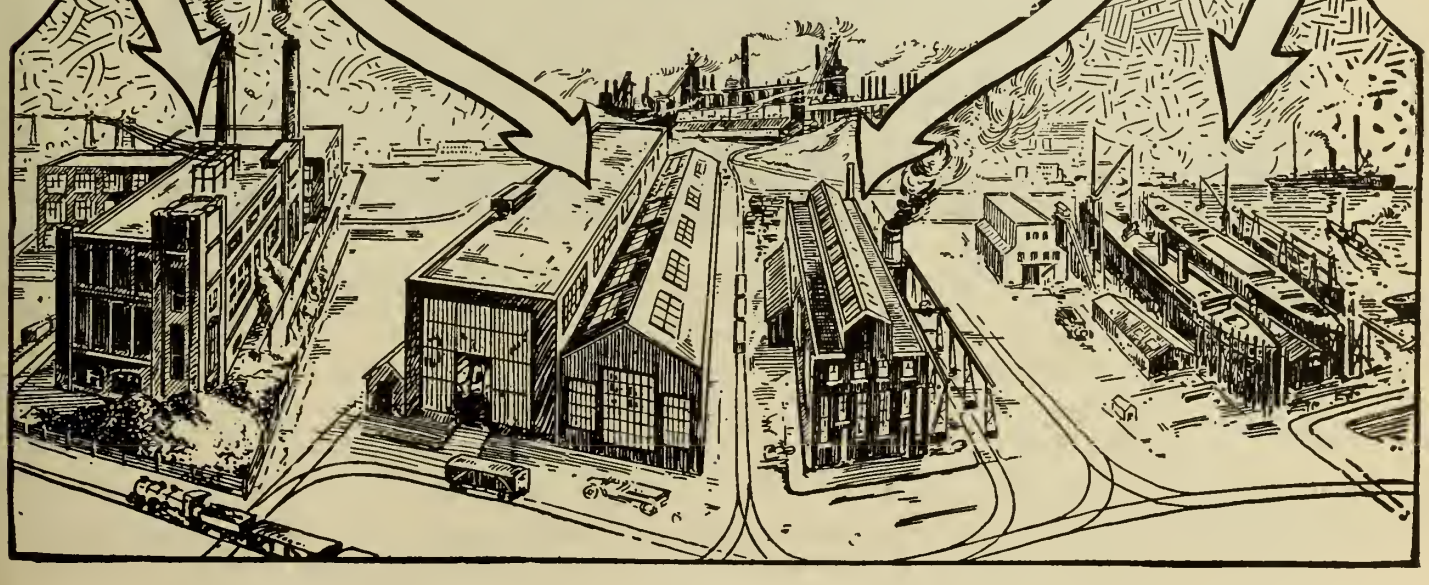
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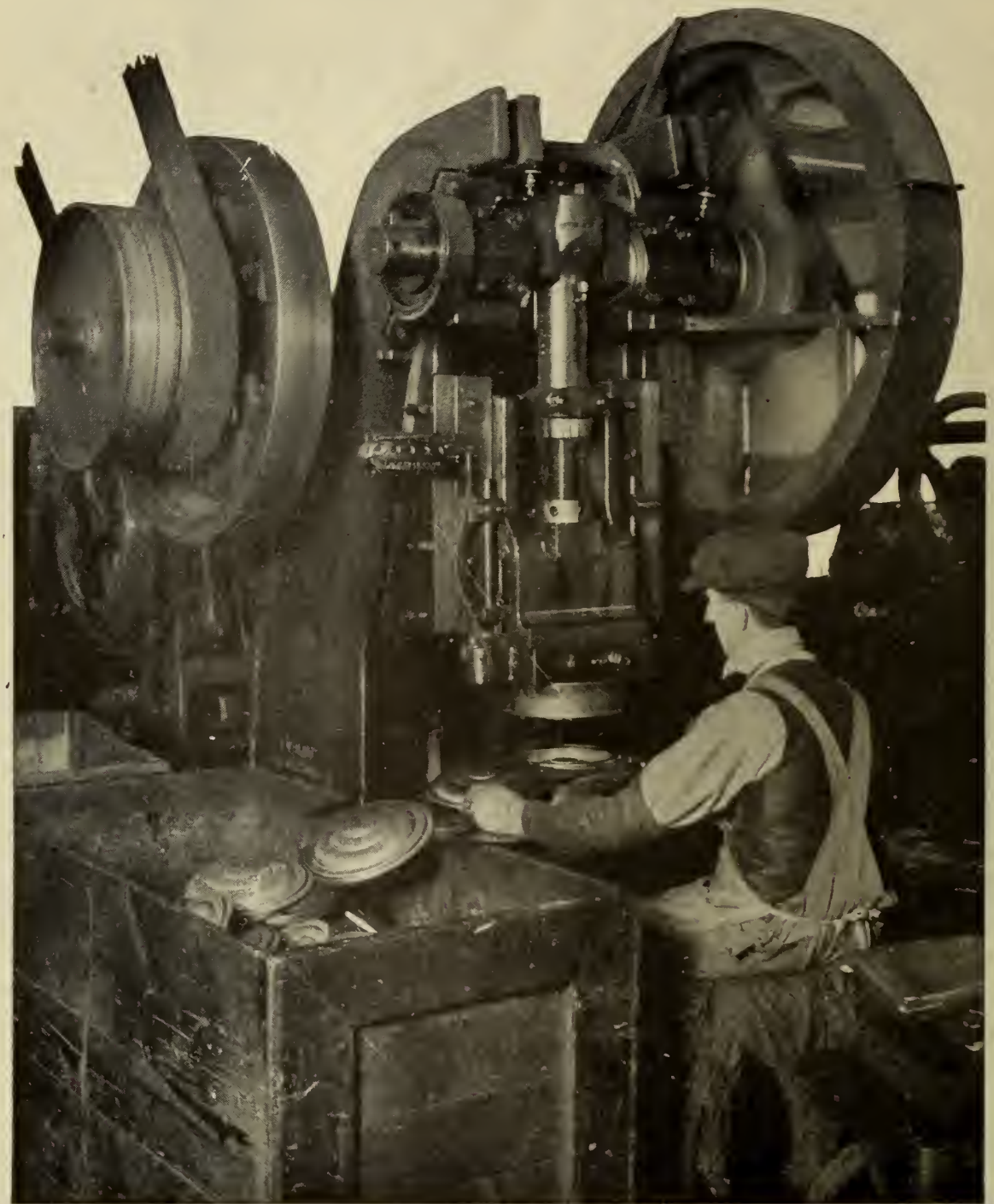
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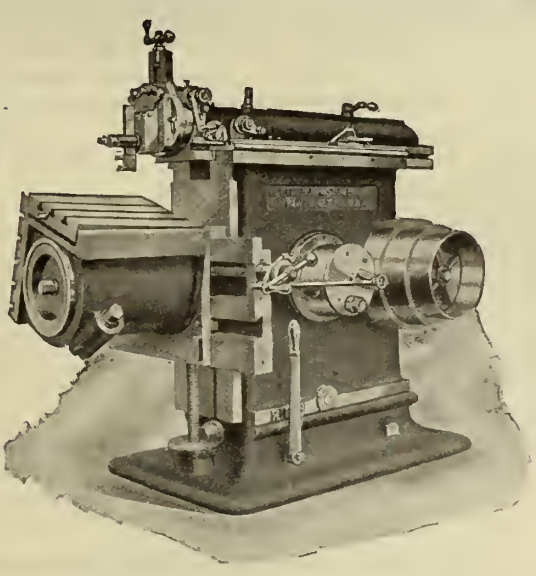
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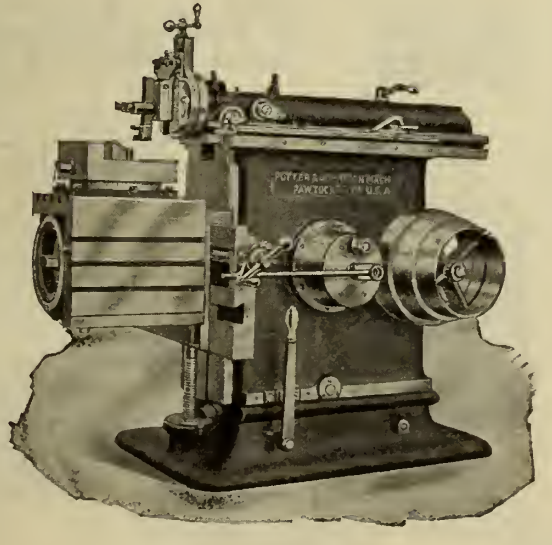
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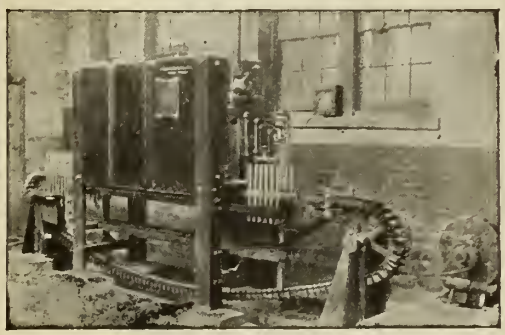
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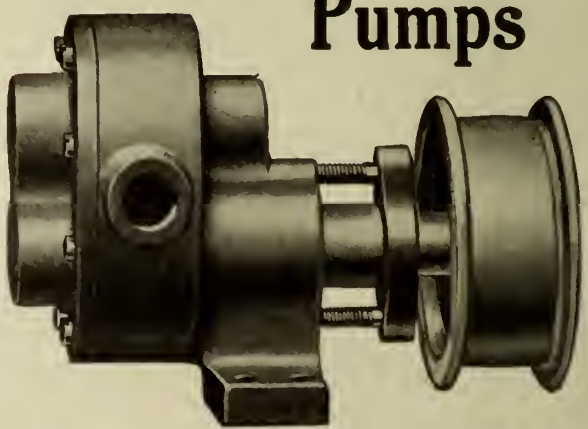
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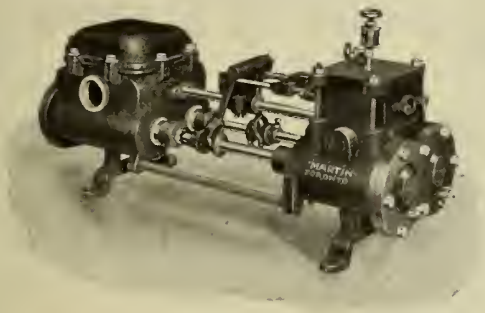
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Sales Agents:

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We Can Supply Pumps from Stock

Do your pumping problems need investigating? Have us do it. We will advise, estimate the cost and build your pump.

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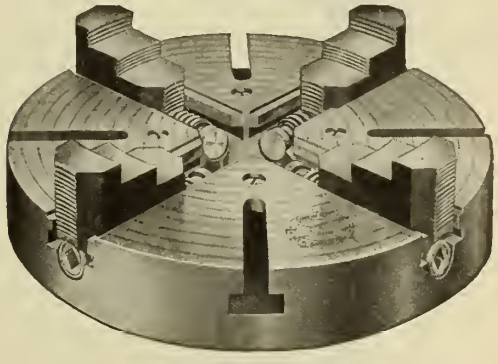
Engineers and Iron Founders

18-60 Van Horne St., Toronto, Canada

ALL STEEL

INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



THE UNION STEEL BODY CHUCKS

are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

UNION MANUFACTURING COMPANY

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Makers of a complete line of chucks

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BABBITTS—METALS—SOLDERS

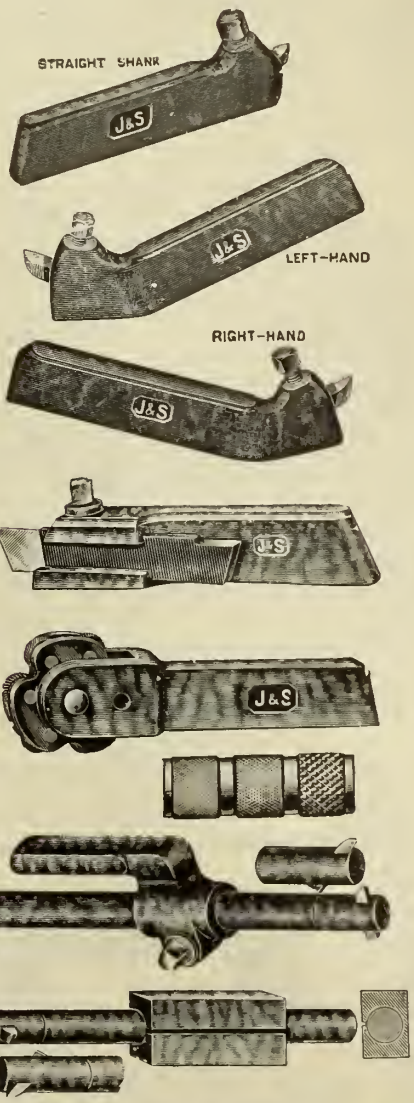
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17 Models. In all the usual sizes



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MODERN EQUIPMENT

is needed to compete successfully.

Specify ARMSTRONG Dogs and Clamps, with Screws made from Chrome Nickel Alloy Steel. They outlast soft steel screws 10 to 1.

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Armstrong Bros. Tool Co.
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QUICK DELIVERIES

High Carbon Steel
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None Better!

Why shouldn't Dominion Wheels be equal to the best made anywhere? They are made in a strictly up-to-date plant from carefully selected raw materials by men who **know!**

Every Dominion Wheel is uniform in quality and gives uniform service on the work it is made for.

You have nothing to lose by giving them a trial.

Dominion Abrasive Wheel Co. Limited
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We shall be glad to supply information on:

Galvanizing, Enamelled Signs, Stoves, Lithographed Ware, Wire Goods, Anchors, etc.

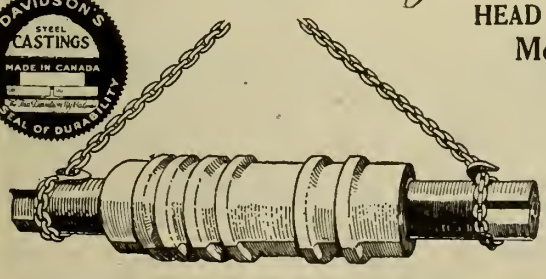
For Shipbuilding, cars, locomotives, and all classes of machinery.

Superior and reliable Steel Castings by the Acid Electric Process can be made up to fifteen tons.

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DAVIDSON'S STEEL CASTINGS MADE IN CANADA THE SEAL OF DURABILITY



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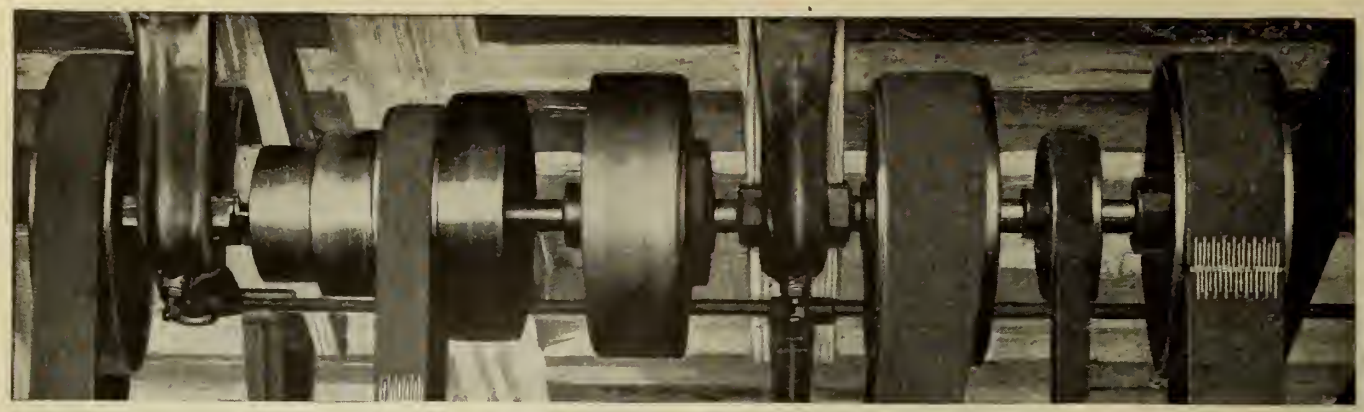
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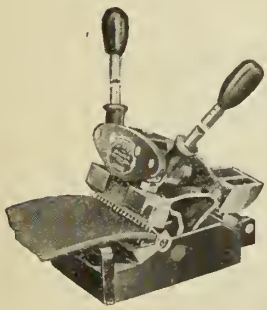
Pittsburgh, Pa. U.S.A.

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Make Your Belt Lacing 100% Efficient

AN EXPERT has conservatively estimated that a plant with one thousand belts will require not less than two belt lacings a day. If laced by hand, or other outworn methods, it would take half an hour's time on each. The loss of one hour's time—to say nothing of lost production—would mean approximately three hundred hours per year, or six weeks of fifty hours a week.



The Clipper Belt Lacer
Laces a Belt in Three Minutes

But let us say it would take the "Clipper" *ten* minutes a day to lace two belts in a 1000-belt plant. The saving would be five weeks' time and production—a saving when condensed that is startling.

Is it any wonder that the speedy, efficient "Clipper" is used in the majority of manufacturing plants in every country in the world?

The "Clipper" has more than speed to commend it. It makes a joint that is smooth and flush on both sides of the belt—that is safe, hugs the pulleys, runs true and is durable. It is backed with a perpetual guarantee, and goes to responsible parties for free trial.

Most mill supply houses sell the "Clipper."
Dealers not stocking it write for particulars.

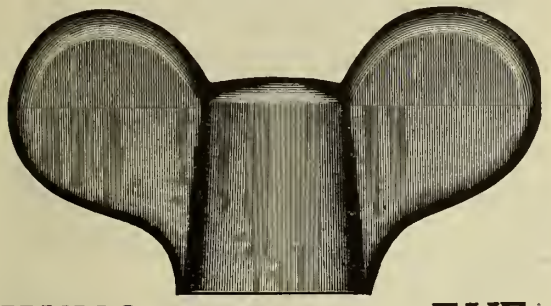
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Clipper Belt Lacer Company
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WING NUTS

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All Sizes

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BABBITT METALS



Imperial Genuine

Made for extra heavy duty, such as Main Bearings on Turbine Generators, Calender Rolls in Pulp Mills, is specially adapted for Marine Engines.



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THE BABBITT METAL WITHOUT A FAULT

For Donkey Engines, Saw Carriages, Small Motors, Transmission Line Shafting and all steady heavy pressure duty.



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Suitable For Slow-Moving Bearings

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Ask for Quotations on Iron and Steel

We have in stock for immediate shipment the highest grade Bar Iron, Black and Galvanized Sheet Iron, Machine Steel, Cast Steel, High Speed Steel, Cold Rolled Steel, etc.

Machinists' Tool Chests



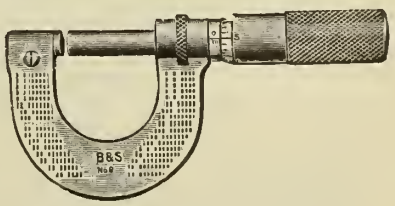
Time and again skilled machinists have remarked on the strength of construction and compact design of our Tool Chests. Have us give you full particulars.

CRESCENT BELT FASTENERS



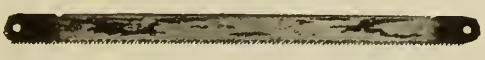
Clinch beneath the surface of the belt on the pulley side — no part in contact with the pulley. They maintain uniform grip the entire width of belt and never weaken from wear.

Micrometer and other fine tools



Select from such wholly dependable makes as Starrett, or Brown & Sharpe, or from other makes you have proven in your own shop to be most durable and efficient. Our stocks are complete.

"Victor" Hack Saw Blades for Tough Metal



Durable, fast-cutting blades that you can rely upon to cut true through toughest metals. Users have found that these blades increase every day's output and serve much longer than ordinary blades.

Write us about your requirements

RICE LEWIS & SON, LIMITED
Established 1847 TORONTO, ONT. 19 Victoria Street

Only Sharp Files Do Good Work

It is impossible for a file that is the least bit dull to do its job properly.

Throw your files away as soon as they show signs of dullness, and buy new ones.

If you want to be sure of getting maximum service before wear is apparent, specify one of the following brands, the standard in files:

Kearney & Foot
Great Western
American
Arcade
Globe

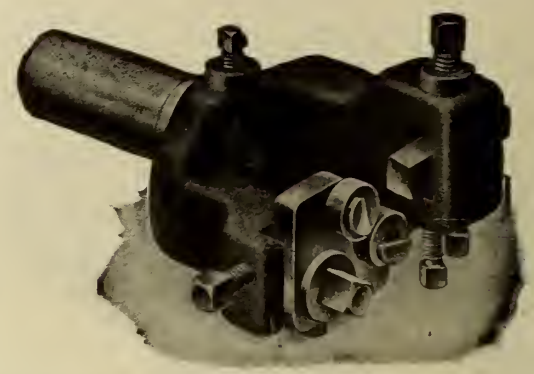
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Made in Canada by

Nicholson File Company

Port Hope - Ontario

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COMPLETE EQUIPMENT FOR CAPSTAN LATHES FULLY ILLUSTRATED IN OUR TOOL LIST E.

J. ACKWORTHIE LTD.
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Our Brands:
"Elkco"
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Elk Service Means Lower Costs

There are two important things to consider in buying firebrick—price and quality. When you buy ELK BRAND FIREBRICK we take a keen, unprejudicial interest in seeing that you get the class of firebrick you need. If a moderate-priced brick fills the bill we never recommend a brick of higher quality at higher price.

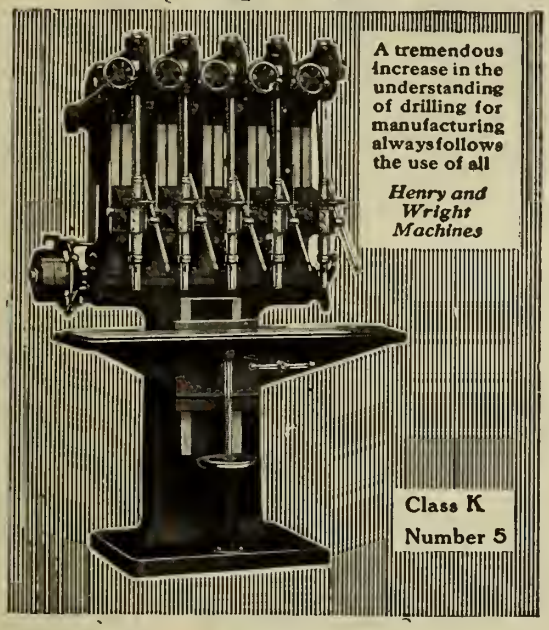
We make bricks in all standard sizes and shapes.

Elk Brands Firebrick are reliable. Specify them in your next order.

Elk Fire Brick Company of Canada
Limited
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Drilling Machines



The Henry & Wright Mfg. Co.

Hartford, Conn.

New York Office: 136 Cedar Street

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FOR TRUEING GRINDING WHEELS

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Sole Canadian Agents for

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ROCKFORD

—the best for varied work

General manufacturing plants prefer the **Rockford Miller** because they require a machine which they can depend on to do any work within its range to the complete satisfaction of the inspection department.

Simplicity of operation and **absolute rigidity under every condition** are distinctively **Rockford** features. They have made this the very best machine for general manufacturing.

Full details on request

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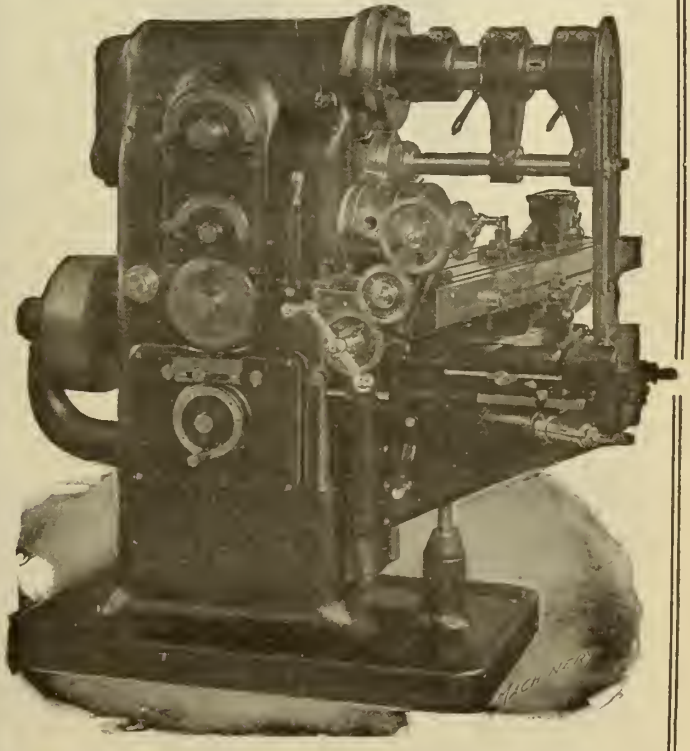
Rockford, Illinois

Agents:

Rudel-Belnap Machinery Co.

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A. A. Jones & Shipman, Ltd., Leicester, England, Great Britain; Louis Besse, Paris, France and Belgium; Societa Anonima Adler & Co., Milano, Italy, Italy and Colonies; Rylander & Asplund, Stockholm, Sweden, Scandinavia; Casamitjana Hermanos, Barcelona, Spain, Spain and Portugal; Selson Engineering Co., Melbourne, Australia; M. Mett Engineering Co., Petrograd, Russia.



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ST. JOHNS QUEBEC



Insure the future success of your new plant by locating there

To the manufacturer locating in St. Johns go all the advantages of a commanding geographical location, unequalled transportation facilities and a cheap and abundant power supply. These features assure every facility in manufacturing and allow him to successfully meet competition.

St. Johns is only 27 miles from Montreal and is directly connected by rail with the Montreal docks, providing unusual ocean shipping advantages. It is particularly suitable as a Canadian location for the American manufacturer wishing to trade within the British Empire.

Seven railroads, including the Canadian Pacific and Grand Trunk, pass through the city and are inter-connected in the St. Johns Yards by a terminal switching company at very low rates.

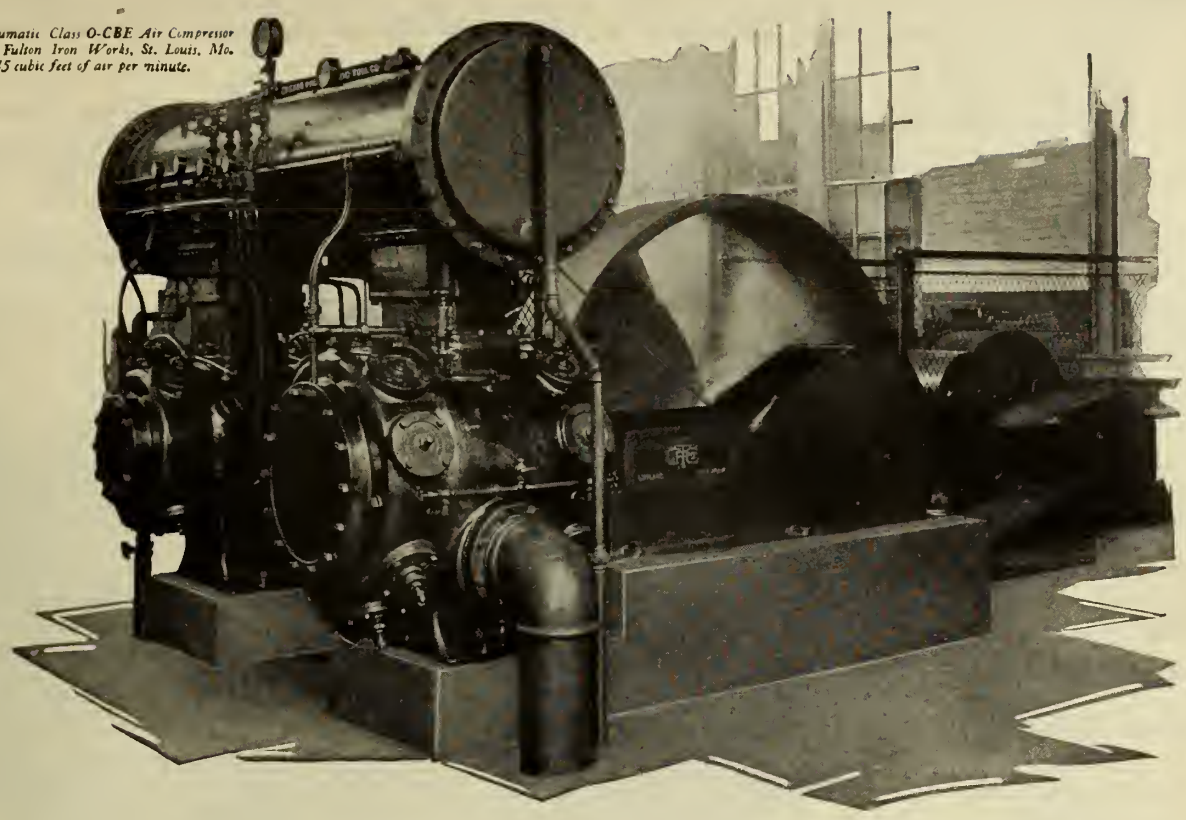
Skilled and unskilled labour is always plentiful, and owing to an unusually low cost of living labour troubles are practically unknown.

To the manufacturer seeking a location for his plant the following inducements offered by St. Johns are especially attractive: Exemption from taxes for a period of fifteen years, same being subject to extension; all public improvements required, such as street extensions, sidewalks, waterworks and sewage; five per cent. bonus on your payroll for five years. If you wish it this bonus will be advanced to you to be applied to the construction of any building suitable to your purpose.

For more detailed information write

The Secretary, City Council

ST. JOHNS, QUEBEC, CANADA



Chicago Pneumatic Class O-CBE Air Compressor installed by Fulton Iron Works, St. Louis, Mo. Capacity 1145 cubic feet of air per minute.

Is your air compressor sometimes a vacuum pump?

IT IS when the inlet is *choked* in connection with the unloading mechanism.

Choking the suction of an air compressor at no load forms a partial vacuum and *wastes power.*

Contrast this with the operating principle of a Chicago Pneumatic Air Compressor. At no load the valves are automatically held open, permitting free air *without vacuum*—gaining a distinct power-saving over compressors using the choked intake system of unloading.

Standardize with Chicago Pneumatics—"the Compressor with the Simplate Valve." Ask for Bulletin 400.

Sales Representatives

The Holden Company, Limited

354-356 St. James Street, Montreal, Canada

Sales and Service Branches TORONTO, 342 Adelaide Street, West WINNIPEG, 150 Princess Street VANCOUVER, 81 Pender Street

Canadian Factory: Canadian Pneumatic Tool Company, Montreal

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BOYER PNEUMATIC HAMMERS · · LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
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CHICAGO PNEUMATIC

The Compressor with the Simplate Valve

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STEEL *for*
Every Commercial Purpose

We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open-Hearth Steel on the Shortest Notice.

Nova Scotia Steel and Coal Co., Limited

Head Offices:
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Sales Offices:
Western Room 14 Windsor Hotel
MONTREAL



Steel Ingots
by the
HARMET
Liquid Process

Heavy Duty Lathes



SIDNEY For Service

Easy Masters of Big Jobs

Dependence put upon Sidney Lathes is never misplaced. Very heavy work can be done without apprehension.

The 25-inch Heavy Duty Quick Change Sidney here shown is the last word in lathe construction. Every possible improvement will be found in this model. Bed lengths of 10, 12, 14, 16, 18 and 20 feet are available. Build also with 27 inch swing.

Write for full particulars of the more suitable machine to-day.

Canadian Agents:
THE YEATES MACHINERY & SUPPLY CO.
Montreal, Quebec
H. W. PETRIE, LIMITED, Toronto, Ontario

The Sidney Tool Co.
Sidney, Ohio, U.S.A.

Lionroyal

The BABBITT For General Service

This Babbitt Metal has a greater range of service than is possible in any other Bearing Metal at a corresponding cost—it has a strength which will easily withstand impact and pressure, yet will run cool at high speed with little lubrication—

There are thousands of places in which high-priced Genuines are used where "LIONROYAL" will serve as well.

ALLOYED UNDER
THE WORLD-FAMED
STANLEY PROCESS



Made in Canada

Try a sample case and judge for yourself.

13 VICTORIA ST.
LONDON, S.W. 1.

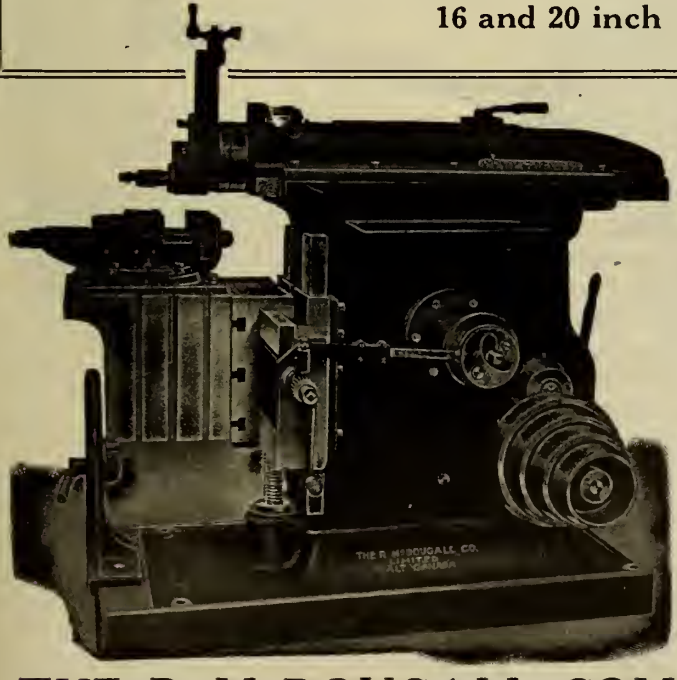
BRITISH & REFINING LIMITED

DRUMMOND BUILDING
MONTREAL

McDougall Crank Shapers

16 and 20 inch

ARE-MAC-DEE IS A GUARANTEE



A Bigger Day's Work—

is made possible with McDougall Crank Shapers than with any ordinary Shaper because the McDougall is built on lines especially for this purpose. It embodies the most approved features of the most practical shapers on the market and care has been taken to exclude all non-essential parts.

The column is massive in construction, well braced and reinforced internally. Exceptional strength is also seen in the ram, which is semi-circular in form and of box type. It can be set forward by crank conveniently arranged.

Slides are square, accurately fitted and with broad bearing surfaces.

Have us explain the other salient points of this finely constructed machine. Full details on request.

THE R. McDOUGALL COMPANY, LIMITED, Galt, Ont., Can.

The Canadian Fairbanks-Morse Company, Limited
Sales Agents

If interested tear out this page and place with letters to be answered.

MACHINE OUTPUT

The performance of a machine should be figured by the year, not merely by the hour. The expected output should properly be based on what the average good operator working with normal effort can produce in a day—not what an expert can do on a short time production "stunt."

This involves fundamentally correct design. In a grinding machine it means rigidity, power, sturdy wheel slide construction to take heavy cuts, well-proportioned bearings and careful heat treatment of vital parts to insure freedom from trouble and delay. It means simple and easy operating control, which assures continuous production without fatiguing the operator.

All these factors are amply provided for in the design of Norton Cylindrical Grinding Machines. The final result is a machine that has revolutionized grinding production—a consistent, rapid producer of uniformly accurate work.

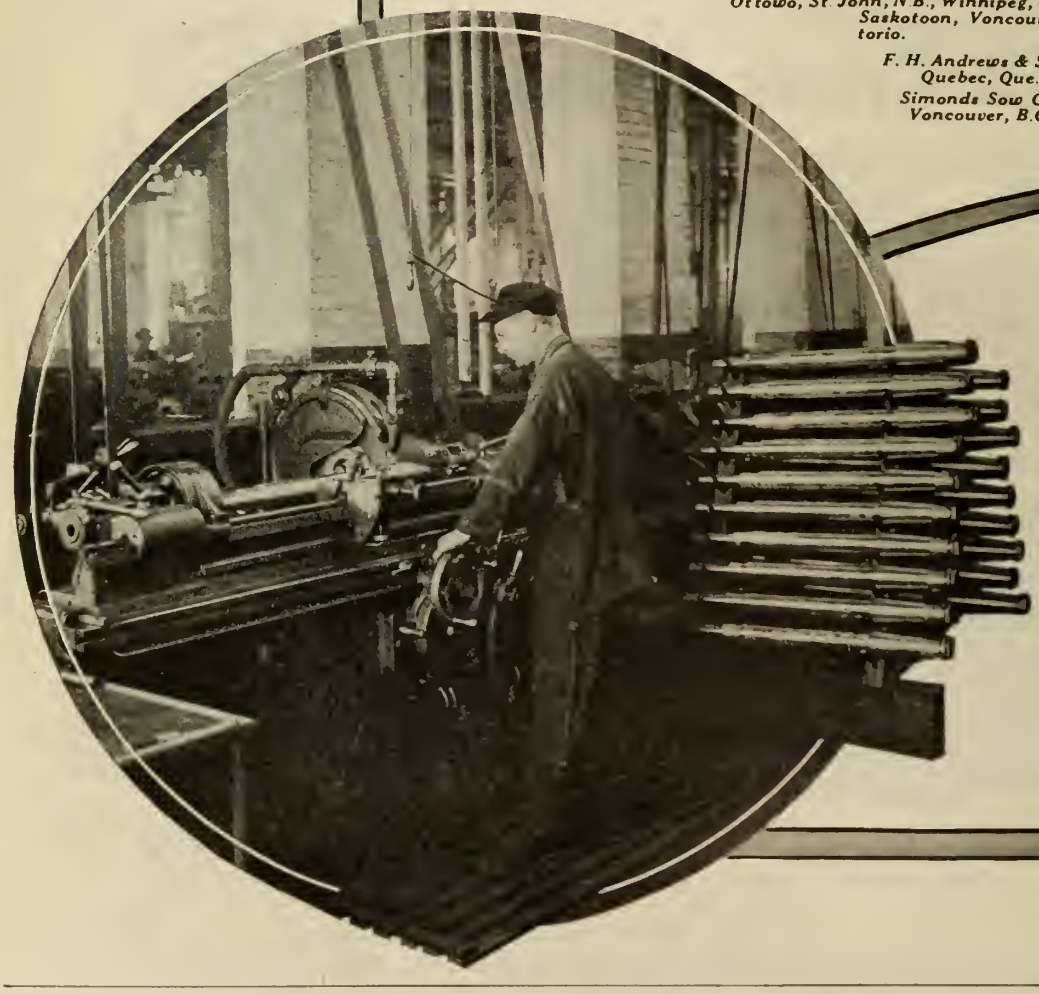
NORTON COMPANY OF CANADA, Limited
HAMILTON, ONTARIO

Electric Furnoce Plonts: Niagaro Falls, N.Y.; Chippowa, Ont., Conodo.

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F. H. Andrews & Son, Quebec, Que.

Simonds Sow Co. Voncouver, B.C.



GISHOLT

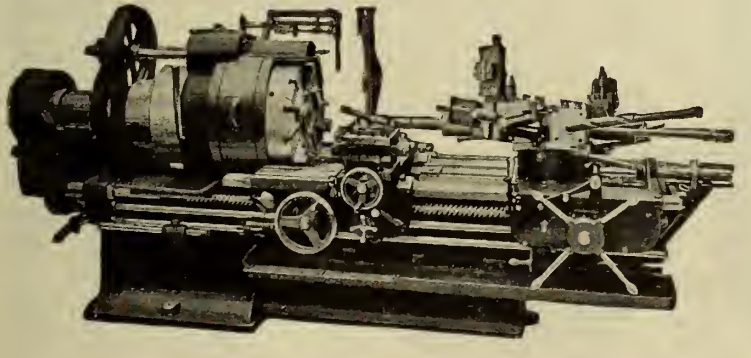


OUTPUT

Finished parts in big quantities delivered to your assembly floor at lowest possible cost.

You can count on a steady stream of work from Gisholt Turret Lathes.

They are big producers. Send for the new catalog.



The Standard Gisholt Turret Lathe equipped with Standard Chucking Tools will handle this work and many other such parts.

GISHOLT MACHINE CO., 1207 East Washington Ave. MADISON, WIS., U. S. A.

Builders of Standard and Automatic Turret Lathes, Vertical and Horizontal Boring Mills, Tool Grinders, Small Tools, Special Machinery, etc.

Eastern Sales Office: 30 Church St., New York. *Works:* Madison, Wis.; Warren, Pa.

Canadian Agents : The Canadian Fairbanks-Morse Co., Ltd., St. John, Quebec, Montreal Ottawa, Toronto, Hamilton, Windsor, Winnipeg, Saskatoon, Calgary, Vancouver, Victoria

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FAIRBANKS-MORSE



The 100% Quality Mark is Your Protection

FROM the Atlantic to the Pacific and into the frozen North, you will find abundant evidence of the confidence in which The Canadian Fairbanks-Morse Co., Limited, and its products are held,

The fisherman with his little boat, equipped with a Type "M" Engine, the coastwise boat with its "C-O" power, the farmer who has solved his labor problem with Fairbanks-Morse power farm equipment, in every great industry—mines, mills, factories and railways, Fairbanks-Morse products are used.

The presence of Fairbanks-Morse mechanical equipment everywhere is the real tangible evidence of confidence that is placed where quality counts and in service that brings seller and buyer together in a closer relationship which builds for the benefit of all.

This is the reason that The Canadian Fairbanks-Morse Co., Limited, has adopted the 100% quality seal as its standard.

When you place an order with any salesman you are buying both service of product, and service of organization.

Our experts are always ready to help work out your problems and are always as close to you as our nearest branch house.

The Canadian Fairbanks-Morse Co., Limited

Canada's Departmental House for Mechanical Goods

Halifax St. John Quebec Montreal Ottawa Toronto Hamilton St. Catharines Windsor Winnipeg Saskatoon Regina Calgary Vancouver Victoria

3

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXIV. No. 20 November 11, 1920

Making One Thousand Milling Machine Saddles

Suppose You Had to Produce One Thousand Saddles Every Year, Like the One Shown—Would You Follow the Method Suggested by the Author?—If Not, Let Us Hear How You Would Do Them

By JOHN T. WATTS

A WELL-KNOWN authority once remarked that there is no method of manufacture existent that cannot be improved upon. Commencing on this assumption, Canadian Machinery decided to give readers something entirely original by requesting certain contributors to state how they personally would produce a well known article at present being manufactured. Various parts were sent out for opinions, and the present article, dealing with the saddle of a milling machine, is both instructive and interesting. It is, of course, understood that the suggestions to follow are the author's and not ours. We take an absolutely neutral stand, merely presenting the author's views. Other material of like nature will follow in later issues, and by thus interchanging ideas mutual benefit will result. We especially wish comments and criticism regarding this series of opinions, and suggest that readers let us have their viewpoint on the present article and its productive suggestions. Here is what the author has to say:

We are to assume that the saddle shown in Fig. 1 has been laid before us to determine and design the tools, jigs, etc., and the best methods of production which will give the lowest cost of manufacture and an interchangeable product for an estimated output of one thousand parts per year.

As interchangeability is the essential point, it will be necessary to make a jig for every operation, even if the output is not increased or the cost decreased by the use of the jig.

The correct procedure for us as the

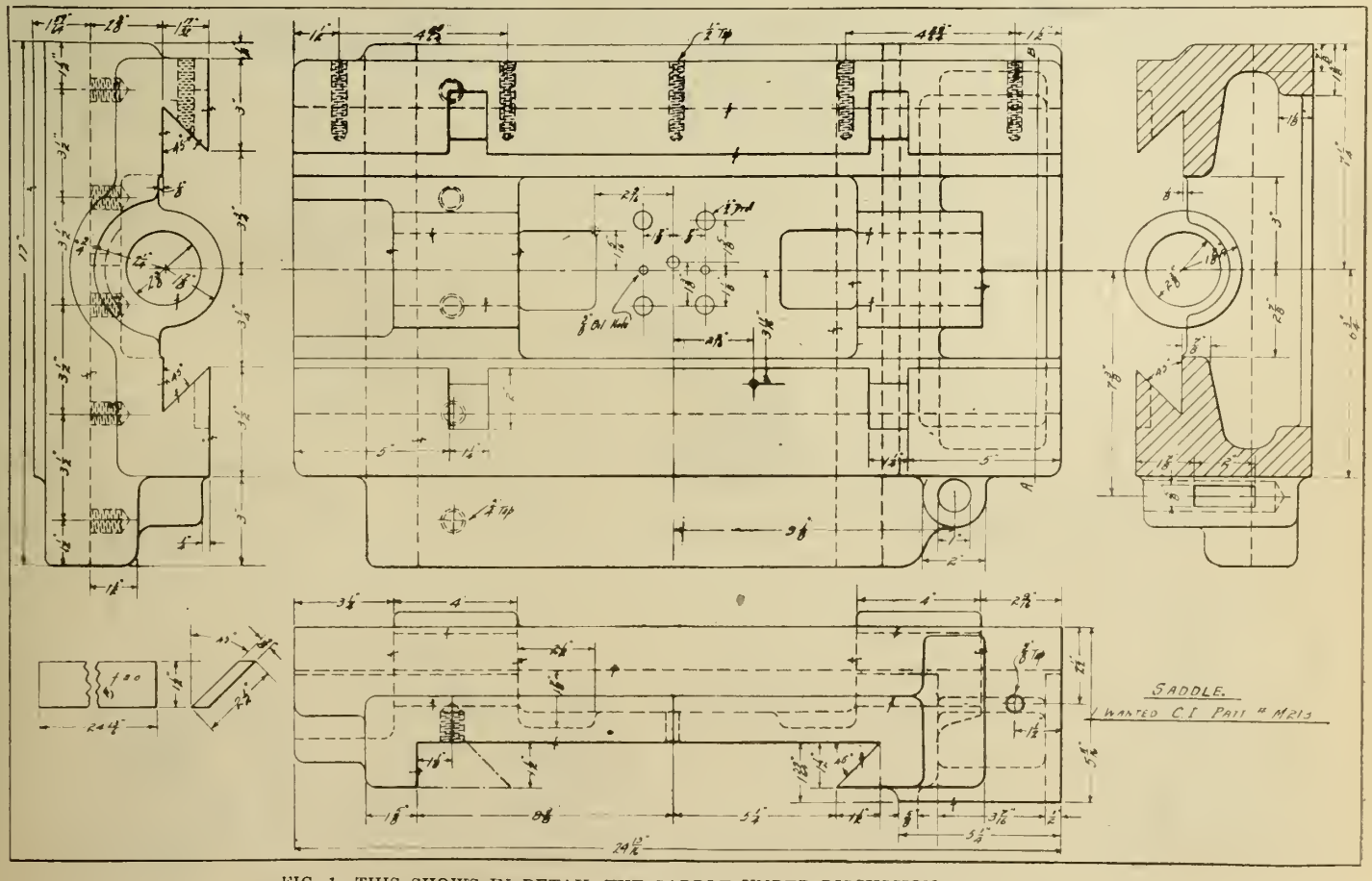


FIG. 1—THIS SHOWS IN DETAIL THE SADDLE UNDER DISCUSSION

production department is to first review the design in a general way with the idea of suggesting modifications in the shape of the part which would enable us to use standard tools or jigs which are already available and to recommend any changes which would assist us to increase production and decrease cost.

Before returning the drawing with the suggested changes to the designing department, the feasibility of carrying out the suggestions should be carefully checked and if possible a sketch made showing our idea of how the change could be made without interfering with the correct functioning of the part in question, or fouling some other part of the mechanism.

The making of this sketch will also serve to assure ourselves that we are not going to make a change that will introduce still worse troubles in some other part.

Taking the saddle before us, we decide that the most desirable way to machine the vees on the top would be by using a form milling cutter, but it looks as though the central boss would interfere, and laying out this part to scale to see just where we stand, as in Fig. 2, we find it impossible to get a milling cutter through with the boss as shown.

As the only alternative method is to plane this vee on a planer or shaper, which is slower and more expensive and more difficult to attain equal accuracy, we are justified in spending some time in an effort to eliminate this central boss.

We will suggest, then, that the design be changed to one of the following, giving the alternatives in the order of choice, that is, from a production standpoint we would prefer the first suggestion first and so on.

Suggestion No. 1. In the absence of drawings of the other parts, we assume that these bosses are only to carry the screw spindle, and possibly this function would be fulfilled as well if only one-half a bearing was used as indicated in Fig. 3.

Suggestion No. 2. In the event that it is deemed essential to have a full bearing, this could be better made a separate casting, bolted in place as shown in Fig. 4.

If either of these suggestions are adopted, the vees can be machined by milling, having one cutter for roughing out and another for finishing, both taking the whole surface at once and being adjustable for wear. The accuracy, being then dependable entirely on the cutter, can be maintained easily and the operation needs only semi-skilled labor.

While suggestion No. 2 may be criticized as involving the machining of more surface than the original design, the total cost would be less, due to the greater ease with which the various operations can be performed and the fact that equal accuracy can be obtained with cheaper labor.

Suggestion No. 3. Continuing our criticism, we find that the vees are shown with sharp corners, which are a practical impossibility because the tool which produces these corners will soon wear off at the point and will then produce the shape shown in Fig. 5 and make it impossible to get a decent working fit at this point, as the fit will only be on the point and after a few days' use the slide will be a sloppy fit. Further, the edge at (a) is easily damaged, for that reason being very poor design. The vee should be changed to the shape shown in Fig. 6, for production reasons and to give a better product.

The dimension (b) in Fig. 6 can be about 1-16 of the height (c).

Experience has shown that the angle of the vees should be 55 degrees instead of 45 degrees as called for in Fig. 1, and as 55 degrees is nearly standard practice, it will be easier to get milling cutters to the 55 degree angle, and therefore it is recommended that the design be changed to give this angle.

Suggestion No. 5. The drawing does not state to what depth the tap drill for

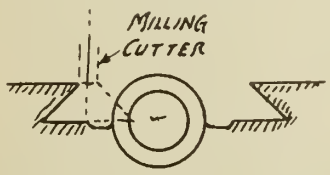
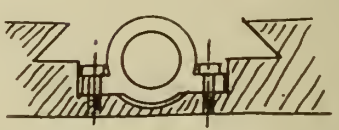


FIGURE-2


FIGURE-3.


FIGURE.4.

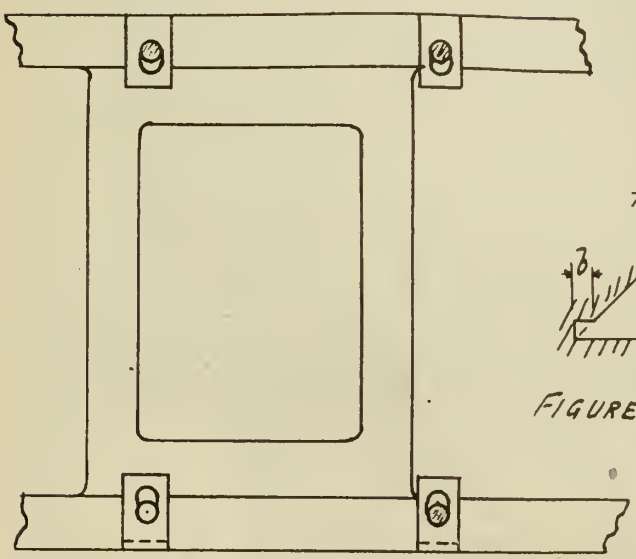


Fig 7

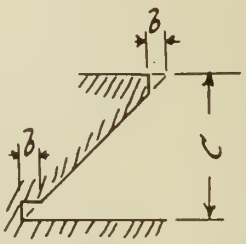


FIGURE- 6

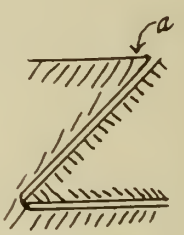
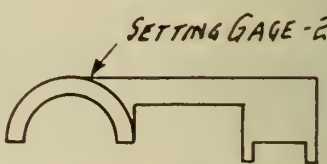
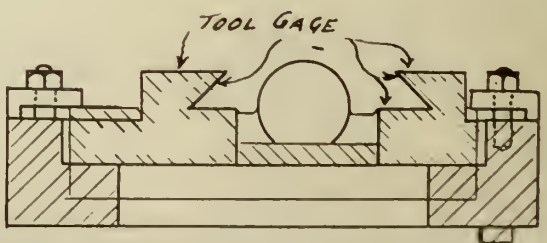


FIGURE-5





FOLLOW THE VARIOUS SUGGESTIONS CLOSELY. FIGS. 2 TO 7 INCLUSIVE

the ¾-inch tapped holes is to penetrate. This is a common omission on the part of some draftsmen and gives considerable trouble in the shop as, if the hole is not tapped deeply enough, the cap screws will bottom in the hole before taking a grip on the part they are to hold, and necessitate dismantling the machine to redrill and retap the holes. Or, as sometimes happens and is still worse, the error is not discovered until damage has been incurred to the machine.

To cover the ground thoroughly we will assume that the above suggestions have been rejected and that we are required to follow the drawing as shown in Fig. 1.

The Start

Starting with the casting as delivered to the machine shop, snagged, cleaned and wire brushed, the first point to be considered is the possibility of the casting warping from shrinkage strains during or after machining. In this particular piece, its shape is not one that would lead us to expect any trouble in this direction, provided that the casting has been allowed to season for a few weeks before work is started.

While experience is the only guide to a decision as to whether a casting is likely to warp or not, it may be stated that a casting whose length and breadth are approximately equal and the shape of which is nearly alike above and below the centre line, is not as a general rule subject to unequal cooling strains which would cause warping.

Nevertheless, the possibility of trouble in this respect should be borne in mind, and the first batch of parts run through should be carefully watched to determine the actual effect of the shrinkage strains. If the casting shows a tendency to warp, we can first try a longer period of seasoning, up to three months, which is usually sufficient to cure any warping in castings of a fairly uniform shape, and is the most economical remedy, as well as being one that tends to a better product, inasmuch as it gives assurance of a shape that will not alter after the machine is shipped out from the factory.

If the trouble still continues, we must rough machine both top and bottom surfaces and then leave the piece to season for a while before taking the finish cuts. This involves a double handling and twice setting up in the machine, and therefore, for economy, should not be used until all other means possible have been tried, even to a redesign of the part to give a more uniform shape.

When a piece is not too large the time required to season can often be very materially shortened by running the castings in the tumbling mill for a few hours. The hammering which the parts receive in the tumbling mill will frequently relieve the internal strains and so remove the cause of the warping.

Before commencing actual production, we will take one of the castings and mark it off on the surface plate, to show the location on the castings of all the finished surfaces, using the centre of the bosses for the 2⅜-inch hole as the starting point. This, because it is important that when finished the 2⅜-inch hole be central in the boss, while a little more or less metal at the other places than the drawing calls for would not be of so much importance. The lines on this casting give us the heights to the working surfaces of our jigs, with the assurance that in working to these heights we will not be taking so much or so little off one surface as to prevent cleaning up on some other surface.

The laying off of this casting also serves as a check on the pattern as to the amount of stock left for machining, and on the foundry as to the casting being true to pattern.

The upper surface seems to be the logical point at which to start the machining, and we must design a jig to hold the castings on the planer, making it to hold as many pieces as the length of the planer table will allow. The general idea of such a jig is indicated in figure 7.

As will be noted the sketch shows only one section of the jig, the idea being to simply repeat this section to fill the length of the planer table, but casting them all in one piece. The jig is made with a key on its lower surface to fit in one of the slots of the planer table as indicated, thus lining up the jig. Lugs for clamping the jig to the table should be provided, but are not shown for the reason that they would complicate the drawing unnecessarily.

The modus operandi is very simple as it is only necessary to drop the saddle into the jig, pressing the projecting part of the saddle against the cross-piece of the jig, to take the thrust of the cut, then slip the two setting gages in place and tighten up the clamps. The setting gage fits the boss on the saddle and the side of the jig and so lines up the centre line of the boss with the jig. The clamps are made with an oval hole, so that it is only necessary to slack up the clamp nuts a turn, when the clamps can be slid back and the saddle removed and the next placed.

At one end of the jig is cast a part for the tool gage, which is machined to the exact shape of the vees to be machined in this jig, but a certain fixed distance larger all over. For clarity we will suppose this distance to be 1-32-in. The tool gage is then machined so that if the planer tool in its travel is always at a distance of 1-32-in. from the surface of the tool gage it will cut the vees to the desired sizes.

The height "d" in figure 7 should be arranged to suit the finish lines on the sample casting laid off on the surface plate.

To machine, first finish the top flat surface, being careful to start the cut from the centre and feed out, to avoid the possibility of breaking off the weak corner, at the top, see "b" figure 6. Next rough out the vees, allowing not over

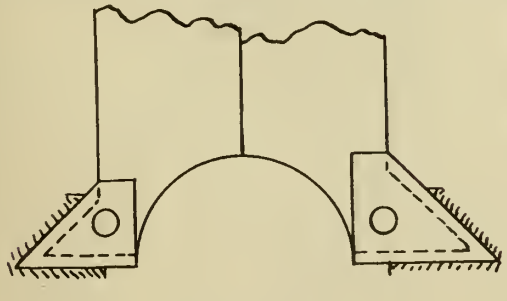


FIGURE 8

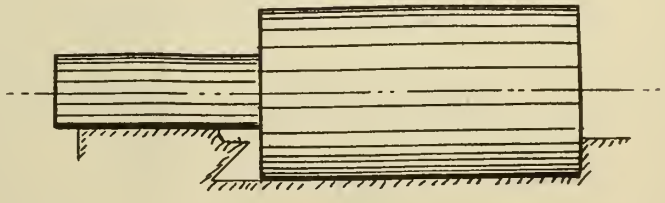
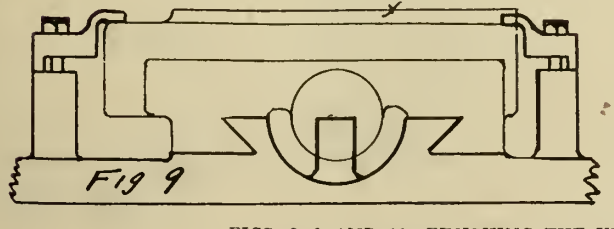
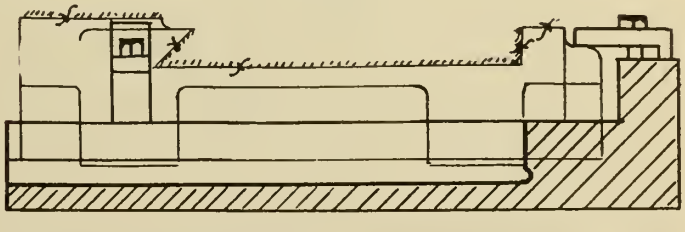


FIGURE 10





FIGS. 8, 9 AND 10—FINISHING THE VEES, AS THE AUTHOR SEES IT

1-64-in. for the finish cut. To finish the vees a form tool should be made, about as shown in figure 8. The holder would preferably be split to admit of being expanded by liners between the two halves to compensate for the wear of the tools. At first sight it might seem simpler to overcome the effect of the wear of the tool by traversing the tool sideways, but, while this is possible, much more accurate results will be obtained if the tool is cutting on both sides simultaneously, as the cut on one side counteracts the tendency of the tool to spring away from the cut on the opposite side.

The next operation will be to machine the lower slide, and a similar jig to that just described will be required, the work being done in a planer precisely as in the last operation. This jig, however, will have ways machined to fit the vees just finished in the last operation, as shown in figure 9, the saddle being pushed onto these machined ways until the central boss hits against the stop provided. The clamps are then tightened up, being similar to those already described for the fist jig.

A still better method, if the machine is available, would be to use a multi-spindle planer type miller, the jig would be the same as shown in figure 9, and the surfaces would be machined, first by a milling cutter in the horizontal spindle as indicated in figure 10, and then completed at the same setting by another milling cutter in the vertical spindle. This second cutter is illustrated in figure II. Doing the work in this way accuracy is easily attained by the use of stops fitted to the feed mechanism.

Boring the 2 3-8-in. Hole

The 2 3-8-in. hole is to be bored next and we must design a jig to do this job in a drill press. The jig must of necessity be made to fit the upper vees, bebecause these were set by the jig to be central with the boss, when being planed. The boring jig is shown in figure 12, the boring tool indicated being of the adjustable multiple type, which can be made or purchased on the market.

The upper guide being hinged can be swung out of the way, and a saddle placed on the jig. A loose bushing is used in the top guide while the first cutter or drill is passing through the top hole, when the top hole is drilled. This bush is removed and the reaming of the top hole completed. The boring bar is then traversed down and the machining of the bottom hole completed. The bottom guide also is fitted with a loose bush which is pushed out by the drill, the drill then fits the guide and holds the bar central until the bottom hole is reamed.

The next operation is to face the bosses, which, the top guide being swung out of the way, can be easily accomplished with a standard spot facing tool substituted for the boring bar in the drill

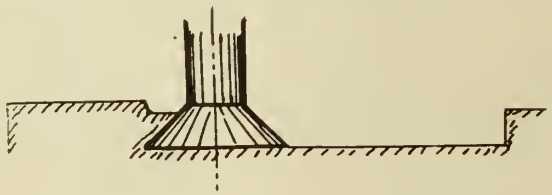
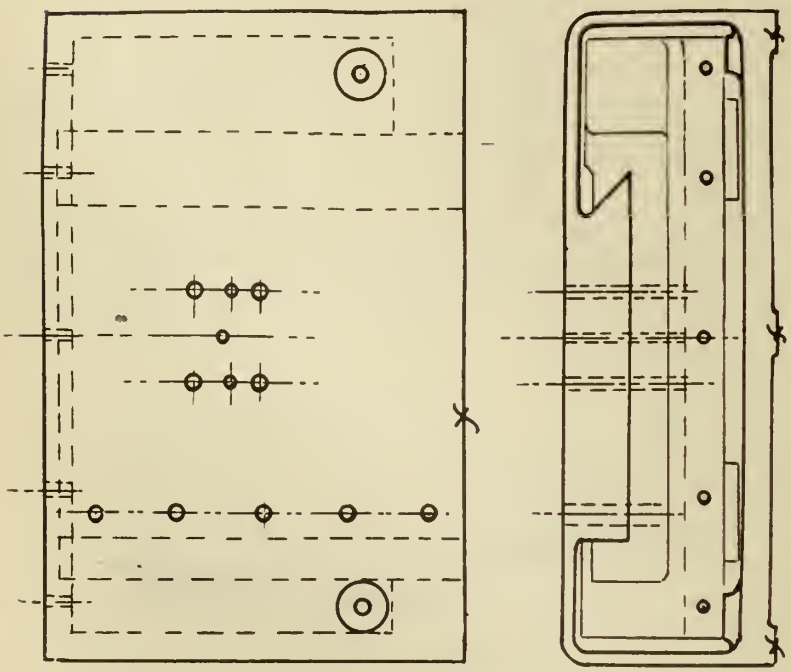
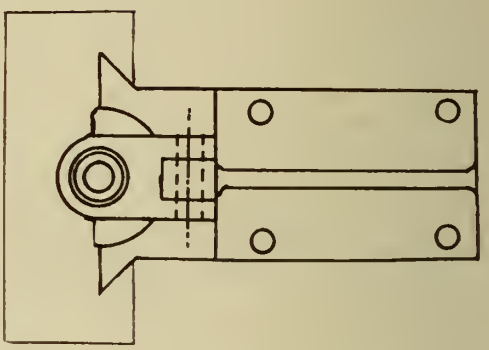


FIGURE 11





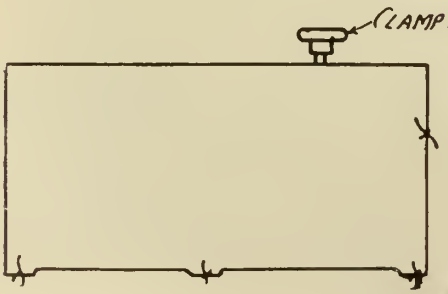


Fig 14

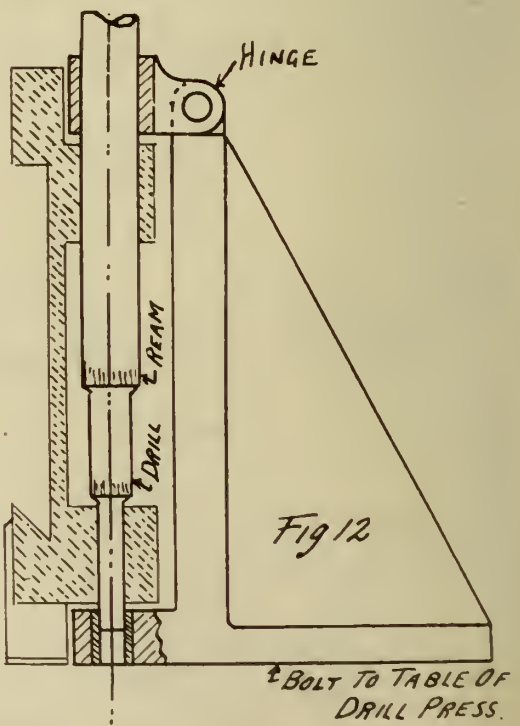


Fig 12

THE REMAINING STEPS IN THE SADDLE'S COMPLETION.

press chuck. The correct location of these faces can be got by marks or stops on the drill press spindle.

The final operation is to drill the small holes, and for those we chose a box type of jig, which will permit drilling all the holes with the one jig. This jig is shown in figure 14, and a study of the drawing will show that the saddle is slid into the jig and tightened by two clamp screws, the casting is located by a part of the jig which fits the lower vees. After drilling the holes on one side, the jig is turned over ninety degrees and the remainder of the holes drilled.

Having laid out the jigs it remains to determine how many machines it will be necessary to have to get the desired output, as it may be that we will have to have more than one of each kind of jig.

Taking up each operation in the order in which they are executed, we have first the planing of the upper vees. The area of the surface to be machined is 24 13-16-in.x15-16-in. or 374 square inches.

Allowing that we can plane 160 square inches per hour, on this type of work, the operation will require 2.4 hours per piece. Bear in mind that in estimating the time required to execute these operations, we should not base our estimate on record outputs made on similar parts, but on the average actual output that we can safely figure on over a whole year allowing for all the accidents, stoppages and other delays that are sure to occur during the course of a year.

Taking 300 working days per year and eight hours per day, gives us 2,400 working hours per year, or exactly the required output of 1,000 per year at the rate of 2.4 hours each. As there should be no difficulty in accomplishing the operation in this time, we may allow that one jig will be sufficient.

The second operation, planing the lower vees, which have a surface to be finished of 17-in. x 24-in., or 408 square inches, will require, at the rate of 160 square inches per hour, 2.5 hours. This is 2,500 hours for the yearly output, and will require two jigs to make sure of getting the output.

The third operation, boring the 2 3-8-inch holes and facing off the bosses will consume about four hours, or a total of 4,000 hours per year. This indicates that we require to make up two jigs.

The drilling and tapping of the small holes should be accomplished at the rate of approximately four per hour, and the one jig will be ample for this operation.

Generally the management will ask for an estimate of the cost of the jigs before issuing instructions to proceed with their manufacture, and the simplest and most accurate way of arriving at this cost is to have a record of the costs of all jigs that are made, with their weight in an accessible form. From this record we take the cost of jig most similar to the one to be estimated on and taking its cost per pound, we can, by calculating the weight of the proposed new jig, and multiplying this weight by the cost per pound arrive at a very close approximation to the actual cost.

Taking up the four jigs, designed for this saddle, we estimate the costs to be as follows: No. 1, $660.00; No. 2, $750.00; No. 3, $200.00; No. 4, $200.00; total $1,810.00

This is a cost of $1.81 for each saddle, assuming that one year will be the life of the jig. Of course its useful life should be much longer than this, but changes in design, or in demand for the product may occur and a year is long enough to calculate on to be on the safe side.

The saving effected by the use of the jigs will, at the lowest calculation, be the saving made by using semi-skilled labor, instead of the highly skilled labor which would be necessary if the jigs were not available.

Assuming that skilled labor would execute the work in the same time without jigs that we have allowed for the semi-skilled labor with the jigs, that is a total time of 9.15 hours per saddle, the saving per piece will be the difference between the rates for that length of time of the two classes of men. Taking this difference at 30 cents per hour, the saving will be 30x9.15, or $2.75 per saddle, to be credited against the cost of $1.81 per saddle for the jigs.

Evidently then, even without crediting the jigs with the value of the assurance of interchangeability of their product, they will pay for themselves in less than one year.

Using New Metals.—A very significant hint was thrown out by the chairman of the Institute of Metals at a recent convention of that body. He pointed out that while the internal combustion engines used to drive merchant ships contained only 3 per cent. of metals other than iron and steel, the driving equipment of the latest British submarines (oil engines, steam turbines, and electrical machinery combined) showed a proportion as high as 37 per cent. Therefore the marine engineer would find in naval practice suggestions for increasing power and reducing weight by using some of the wonderfully strong yet light alloys which British metallurgists had developed.

INTERESTING FACTS TO BE FOUND IN THIS WEEK'S ADVERTISING SECTION

1. How to do more with a——but wait— that would be telling.
2. That you can never be too sure, whether you are producing your work at fastest possible speed, or not.
3. An item that should interest every apprentice.
4. A machine said to be a great time saver. A product that requires no machining.
5. How to get away from idle time.
6. Something that is not an experiment.
7. A product that depends on more than speed.
8. How to get out a bigger day's work.
9. That you can lose power very easily.
10. How the performance of a machine should be figured.
11. How to receive dollar for dollar value.
12. A case—where—ASK—and you receive.
13. How to increase production, yet lower operating cost.
14. Something that pays you well.

NOTE.—Readers are sending in as many as four names to the one question. This is hardly fair to the other chap who sends in only one, so that in future, two suggestions only are allowed per question. Another rule will be that no answers will be considered later than three weeks from date of publication. Always specify the date of issue and write your answers on separate sheet of paper. There is no need to write the queries over, merely say query No. 1 and so on.

The Engines Used in Early Railroad Practice

Continuing Our Story of Last Week on Transportation We See Herein a Few More Examples of the Early Type—In a Later Issue the Modern Locomotive Will Be Discussed

By J. SNOWDEN BELL

MR. A. MEHAFFEY, superintendent of motive power of the Allegheny Portage Railroad division of the line, to which the British engines had probably been transferred, goes much further than Mr. Gay in reporting unfavorably on them. In a report of November 1, 1836, he says: "Two of them, viz., the 'John Bull' and 'Red Rover,' both British engines, have recently been sold, and it would have been a saving to the Commonwealth had they been given away for nothing the first day they were placed on the track."

Data on English Engines

This statement savors so strongly of prejudice as not to be worthy of credence, and the temperate and reasonable criticism of Mr. Gay correctly indicates the reason for the failure of the British engines to give satisfactory results in service. As they were not equipped with trucks, it is obvious that they were not well adapted to traverse the short curves of the line, as also their comparatively light construction, noted by Mr. Gay, impaired their hauling capacity. It does not, however, by any means, necessarily follow that they were either worthless or could not have been used, with reasonable advantage, in lighter service.

The five British engines, which are stated, in Mr. Mehaffey's report, as being the "Albion," "Atlantic," "John Bull," "Fire Fly" and "Red Rover," were built by Robert Stephenson, of Darlington, England, and were all four-wheeled machines, having one pair of driving wheels and one pair of carrying wheels, which were journalled in pedestals rigid with the main frame, and consequently had no capacity of relative radial or lateral motion. Messrs. Robert Stephenson & Co., Ltd., of Darlington, England, have furnished a drawing entitled "Steam Engine No. 54" (builder's number) and a more complete blue print, "Working Drawing of Nos. 110, 112, 113 Locomotives, March 24th, 1835; Nos. 129, 139, March 4th, 1836," together with tables of dimensions of "Locomotives supplied to the United States Railways," and the writer has also received from an English correspondent a copy of a list headed "Locomotives built by Robt. Stephenson & Co. for the U. S. A. between 1831-1836," purporting to be made up from Wishaw's Railways of Great Britain and Ireland, 1st Ed., 1840, Tables 27 and 28, Sec. 2.

From the above data it would appear that in three of the five locomotives built for the Philadelphia & Columbia R. R., the driving and carrying wheels were of the same diameter, and in the other two the driving wheels were of greater diameter than the carrying wheels. The engines of these two wheel arrangements are not, however, indicated by name in the lists.

Fig. 9 is a reduced reproduction of the builder's blue print showing the engines having driving and carrying wheels of different diameters, the dimensions of one of the engines being given as follows: Light weight, 8 tons, 11 cwt.; cylinders, 12 x 8 inches; driving wheels, 5 feet diameter; carrying wheels, 3 feet 6 inches; boiler, 3 feet 4 inches diameter, 8 feet long; firebox, 2 feet 5 inches x 3 feet 2½ inches x 3 feet 5¼ inches; height of chimney above rail, 14 feet 6 inches. These dimensions are not, however, entirely in accord with those appearing in the list from Wishaw's book, in which the cylinders are stated to be 10 x 16 inches. The cylinders of the engines having driving and carrying wheels of equal diameters (4 feet 6 inches) were 10 x 16 inches.

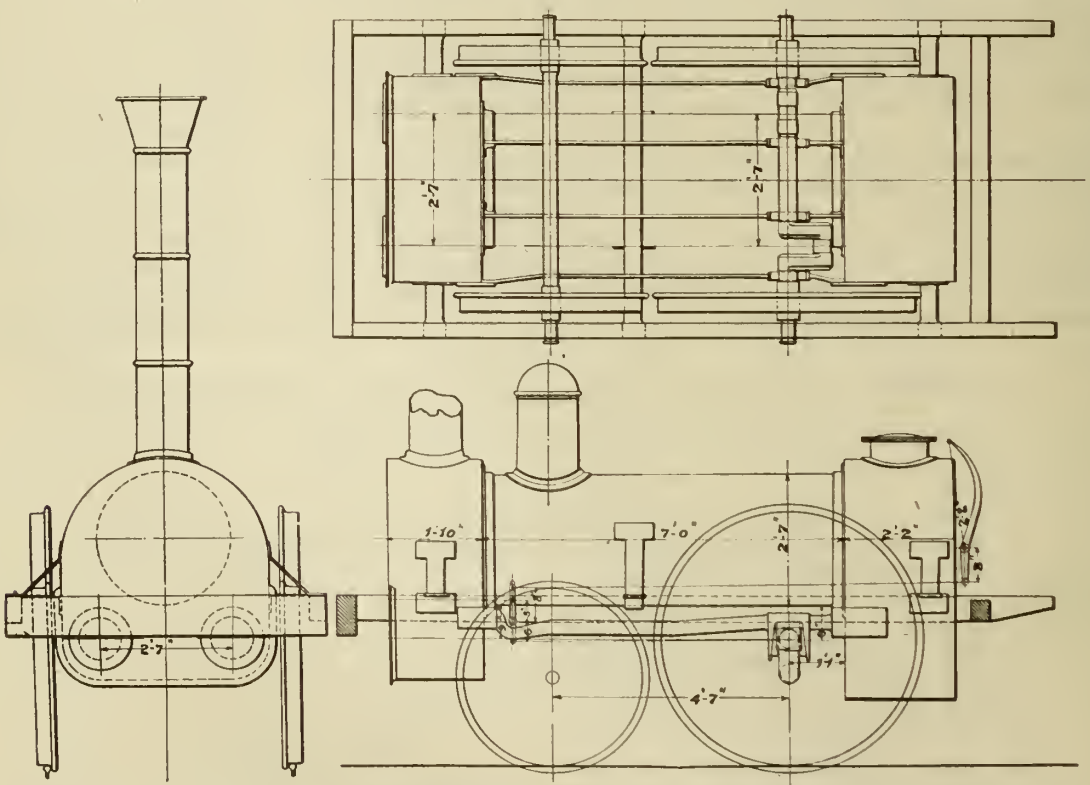


FIG. 9—A REDUCED REPRODUCTION OF THE BUILDER'S BLUE PRINT. SEE TEXT FOR FURTHER DATA

The principal engineer's report of October 30, 1835, states, as before noted, that among the seventeen locomotives then in service there was one that was built by Coleman Sellers & Sons, and Mr. Mehaffey's report of November 1, 1836, specifies two, the "America" and

"Sampson," as built by C. Sellers & Sons, and first run September 1, 1836. The only data that have been obtained regarding these engines is that contained in a letter from Mr. Charles Sellers to his brother, Mr. George Escol Sellers, dated July 23, 1884, and a rather crude wood-cut of a locomotive appearing in an advertisement of Coleman Sellers & Sons, Cardington Iron Works, which is here reproduced as Fig. 10.

The following excerpt from Mr. Sellers' letter contains all that he says which is descriptive of the locomotive:

"Our first locomotive was put on the railroad in 1835. I ran it for one week before we asked the commissioners to take a trial trip to Lancaster and back. It was outside connection, centre-bearing on the truck and iron frame. I recollect great objection was made to the iron frame, as it would not give to the inequalities of the road; all of the English locomotives, and I think two of Baldwin's on the Pennsylvania Railroad, were wooden frames.

"They (the commissioners) said that we had to pay Baldwin $500 for a patent attachment to throw part of the weight of the tender on the driving wheels, which we did not use, but that we had put on a patent attachment of our own to throw part of the weight of the forward end of the engine on the drivers, which they thought was much better, as it was self-acting. The drawing for the engine most have been made in 1835 (I think earlier, because we had to get the boilers made in New York, and very poorly made at that)."

The traction increaser referred to in this letter was doubtless that of the patent of C. & G. E. Sellers, May 22, 1835. The principle of the invention is stated to be: "So coupling or connecting the cars containing the load to be drawn to the body of the locomotive engine, as that the load by its action upon a lever or standard shall tend to raise the fore end of the locomotive in any desired degree, and thus to loosen the pressure upon the fore, and transfer the same to the hind wheels." The appliance is very crudely shown and described, and it is not at all clear how the tender or train is to be connected to it, but, if operative, it must have been, as stated in the letter of Mr. Sellers, "self-acting."

The early motive power of the state system also included a locomotive built by Long & Norris, the "William Penn," stated in Mr. Mehaffey's report as having been first run October 14, 1835, and a number of locomotives of the same type, built by William Norris, among which were the "George Washington," "Robert Morris," "Benjamin Franklin," and "Washington County Farmer," which are stated, in the same report, to have been put in service at different dates in the year 1836.

All the locomotives built for the state by William Norris and his successors up to the year 1840, or thereabouts, were of the 4-2-0 type, and were, in all essential particulars, similar to that shown in Fig. 11, which represents one of a lot of seventeen constructed by him for the Birmingham & Gloucester Railway, England. They did not materially vary in dimensions from the "William Penn," the weight of which was 23,560 pounds, of which 14,600 pounds were on the driving wheels; cylinders, 10 x 20 inches; driving wheels, 4 feet diameter; boiler, about 14 feet long and 36 inches diameter; grate area, about 9 square feet.

Respective Merits

The merits of the respective locations of the driving axle in the Baldwin and the Norris engines, i.e., behind the firebox in the former and in front of it in the latter, were often the subject of discussion during the period that the 4-2-0 type continued to be practically the only one in service. Those who favored the Baldwin arrangement correctly maintained that it gave the engine a longer wheel base and thereby rendered it steadier at high speeds, while the advocates of the Norris design, with equal correctness, pointed out that it increased the adhesion and tractive power of the engine. The advent of the 4-4-0 type rendered the question an academic one, and meanwhile, on the lines of the state system, the Baldwin engines were generally preferred for passenger service and the Norris engines for freight. Both classes undoubtedly gave as efficient service as was possible with their limited capacity, and the reports of the performance of the Norris engines were uniformly favorable. Indeed, the report of J. W. Patton, superintendent of the Allegheny Portage Railroad, October 31, 1838, went so far as to make the statement (which would seem to be of doubtful correctness), that "of the locomotives now on this road those made by Mr. William Norris, of Philadelphia, are much superior, doing double the amount of work, with half the quantity of oil and fuel, and not requiring half as much repairs."

All the motive power thus far referred to was constructed in Philadelphia and first put in service on the Philadelphia & Columbia Railroad division of the line, although some of the locomotives were, from time to time, transferred to the Allegheny Portage Railroad and their places supplied by new ones. For some reason, which is not apparent, the canal commissioners placed their orders for locomotives intended for service on the Portage road, in other cities, and on the opening of the road for traffic, in the season of 1835, three locomotives were ready for service on the long level between inclined planes 1 and 2, these being the "Boston," "Delaware," and "Allegheny." The following matter relating to these three engines is taken from the extremely interesting "History of the Pennsylvania Railroad," by William Bender Wilson, Philadelphia, 1899 (Vol. I, pp. 121-123):

"The 'Boston' was the first locomotive to do service on the Allegheny Portage Railroad. It was built by the Mill Dam Foundry Company, of Boston, Mass., and delivered at Johnstown just before the close of navigation in 1834. It was put in condition during the winter and sent to Pittsburgh to be used as a pattern. It was returned to Johnstown, March 28, 1835. Without water or fuel it weighed 8½ tons. Its cost, exclusive of tender, on the wharf at Boston, was $6,996.75. The cost of transportation to the railroad amounted to $223.25. It was put into regular service May 10th, and until November 1, 1835, made its regular trips, covering 52 miles daily, with the exception of 2½ days, when it was laid off for repairs, which cost $17. Engineer Welch, in reporting upon its services in the time mentioned, said of it: 'This engine during the greatest part of the season, in connection with its other work, has hauled the passenger cars in both directions each day. This detained it; otherwise it might have made three trips a day for the greater part of the time. It performed the labor every day of eighteen horses, and it might do easily one-third more if it were not necessary to reserve it for the

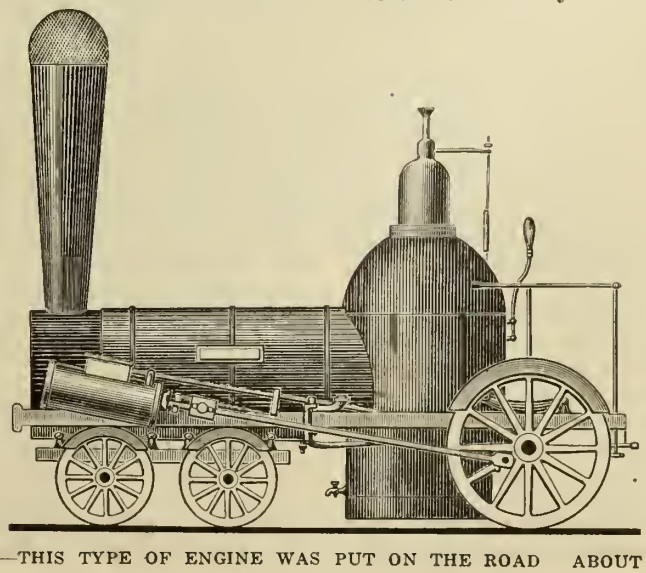


FIG. 10—THIS TYPE OF ENGINE WAS PUT ON THE ROAD ABOUT 1835

transportation of passengers. The daily expenses of running it are $7.12½, exclusive of repairs.' Its cylinders were 8 inches in diameter, with a 16-inch stroke, whilst its driving wheels were a small pair, 4 feet in diameter, with wooden felloes and spokes. The wheels were tired with iron and were flangeless. During the season of 1835 it was in service 174 days, averaging 52 miles a day distance, and 10 miles per hour speed. Its steam pressure was 125 pounds to the square inch.

A Different Story

"The 'Delaware' and 'Allegheny' were not so satisfactory, and were a source of expense and vexation during the season. They were built by Edward A. G. Young, of New Castle, Del.; reached Hollidaysburg, April 15, 1835, and were sent to Johnstown where the parts were fitted together and the necessary alterations made in an ordinary blacksmith shop, there being no machine shop in operation at the time. Their contract price was $5,500 each, and it cost $158 additional per locomotive to transport them from Philadelphia to Hollidaysburg. Better results were expected of them than from the 'Boston' because the boilers were larger and would generate more steam. The machinery was arranged differently from that of most other engines built upon the same general principles. It was apparently more simple, but less substantial. The builder had had several years' experience in the use of locomotive engines, and it was expected that the deviations made by him from the general plan, and from the engine designated in the contract as the model according to which he was to build for the Portage Railroad, would be an improvement inasmuch as they were to be put up and tried upon the railroad by persons furnished by the builders and approved of by the engineers before they were finally paid for.

"The 'Delaware,' after running for four days, broke its crank axle, and had to remain idle until the 1st of September before it was repaired by the contractor. The 'Allegheny,' after considerable refitting, was accepted. It ran about two weeks when its crank axle broke, rendering it useless for the balance of the year. These three locomotives performed all the service they did for the year on the 13-mile level. The 'Pittsburgh,' built upon the plan of the 'Boston,' was constructed by McClurg, Wade & Co., at Pittsburgh, at a cost of $4,500, and was delivered on the road on September 3, 1835."

On page 127 of the same volume there is given the following description of the performance of a locomotive which had been ordered for the Philadelphia & Columbia Railroad, and was tested on its way thereto on the Portage road:

"It was during this year (1836) that a question of what power should be used on the Hollidaysburg level, that had been agitated for some time, was settled. As the steepest grade on that level was fifty-two feet to the mile there was a great diversity of opinion as to the ability of a locomotive engine to work on the level. The authorities had contracted March 24, 1836, with McClurg, Wade & Co., of Pittsburgh, for the construction of a locomotive named the 'Backwoodsman,' for use on the Columbia & Philadelphia Railroad, and as that machine was ready for delivery, the board of Canal Commissioners ordered that it be delayed en route to be experimented with on the level.

"Arriving there in the latter part of September, it was worked under the charge of Messrs. Bridges and Whitney for several days, and proved that locomotives could be used with ease and economy there. At the first trial it arrived at the Hollidaysburg scales from the foot of plane 10 in eleven minutes, hauling eight heavy bloom cars. Its next trip, with thirteen heavily laden cars, occupied twelve minutes."

The report of J. Snodgrass, superintendent of motive power of the Allegheny Portage Railroad, who took charge February 15, 1839, states that there were then seventeen locomotives on that road, the largest portion of which had been used on the Columbia road previous to 1835. These included nine built by William Norris; one, the "Boston," by R. M. Houton; three, the "Allegheny," "Delaware" and "Comet." by E. A. G. Young; and four, the "Backwoodsman," "Mountaineer," "Conemaugh" and "Pittsburgh," by McClurg, Wade & Co., of Pittsburgh, Pa.

Development of the inefficient and wasteful management, and demoralizing results of improper exertion of political influences, which, in the view of the writer, are characteristic of government ownership, began almost upon the inception of the operation of the main line of the Public Works of Pennsylvania thereunder. A recital of details would be foreign to the purpose, and beyond the permissible compass of the present paper, but an instance is presented in the explosion of the boiler of the engine "Bush Hill," on the Allegheny Portage Railroad, April 23, 1847, a report of which was made June 10, 1847, to the Committee of Science and Arts of the Franklin Institute, Philadelphia, by Mr. Edward Miller, a civil engineer of the Pennsylvania Railroad. This report is published in the "Journal of the Franklin Institute," whole No. Vol. XLIV, 1847 (pp. 69-71), and being believed to be specially interesting, it is here reproduced in full, attention being particularly called to the italics, which are those of Mr. Miller, and to his concluding paragraph:

Details of the Accident

"John C. Cresson, Esq.,
"Chairman of Committee on Science and the Arts, Franklin Institute.

"Dear Sir:—Upon the day I passed over the Allegheny Portage Railroad, April 23rd, 1847, one of the locomotive engines attached to a freight train exploded, killing the engine driver and injuring severely two other persons. I could not, at the time, obtain a correct statement of the facts, as business required me to proceed the same night to Pittsburgh. Being at Johnstown on the 4th inst., I had an opportunity of examining the wreck and enquiring into the facts connected with the explosion, which I now send you, to be laid before your committee, if you consider them of sufficient importance

"The locomotive 'Bush Hill' was built by Messrs. Norris, and put on the Columbia Railroad April 17th, 1837. In the fall of the same year it was transferred to the Portage, where it has since been in constant use. It was a six-wheeled engine, weighing 12 tons, being one of the heaviest on the road, used the adhesion of two wheels, and was considered one of the best machines on the Portage. It was generally used as a freight engine, but had been running on the 13-mile level for some days prior to the morning of the accident, with the passenger train.

"On that day the steam was raised by the fireman before breakfast, with the expectation that the 'Bush Hill' would have to take the passenger train; but the regular passenger engine, which had been undergoing repairs in the Johnstown shops, arrived and took its place. But for this change the loss of life might have been much greater.

"The fireman, John B. Davis, states that he tried the gauge-cocks before going to his breakfast, and found the water above the upper cock. He also tried them after breakfast, before the engine started, and found a full head of water.

"The engineer of the 'Bush Hill,' James Patterson, had gone down to Johnstown the night before to ask that another person might be sent to run his engine, as he wished to attend a funeral. James Barron was accordingly sent up with him by the passenger line in the morning to Incline Plane No. 1; but, as the funeral was to take place at the halfway house, it was concluded that Patterson should run the engine that far, Barron accompanying him. The 'Bush Hill' was attached to a freight train, and after proceeding about one-quarter of a mile exploded, killing Patterson and wounding Barron and Davis badly.

"The only part of the boiler which gave way was the forward flue-sheet, the upper part of which was torn from the flanch by which it was riveted to the boiler, as far down as the upper row of copper flues, which was also torn loose. The remaining flues, and the whole cylindrical part of the boiler, together with the dome and fire-box, sustained no injury from the explosion. The rent followed strictly the angle of the flanch without starting a rivet. The rush of steam forward threw the engine entirely over, and it fell backward, bending the platform against the dome, and

crushing the tender and one of the cars. The working gear was much bent and broken.

"The flue-sheet was made of two plates riveted together; the lower one, through which the flues passed, being of three-eighths of an inch iron, and the upper, one-quarter inch. The upper plate was strengthened originally by two stay-bars, both of which were broken off, their fractures showing that they had given way long before. No signs of want of water, nor of overheating, appeared in the flues, fire-box, or any part of the boiler.

"The angle of the flanch of the flue-sheet where the rent occurred was probably injured originally in the bending, as a very bad flaw extends not only around the fractured part, but also around the portion below the flues, which was not injured by the explosion. I have sent two portions of the flanch by Mr. Power to the Institute, from which this will be apparent.

"Mr. James Bowstad, the foreman of the Johnston shops, says *he noticed last winter that the flue-sheets of several of the locomotives, including the 'Bush Hill,' were sprung*, and he believes that in all these cases the stay-bars are broken. The other engines which are in this condition are in daily use on the road, and they are unable to repair them, because there are no spare engines to supply their place. He considered 'Bush Hill' in good order in all other respects. He says that he examined it the day before the accident in order to ascertain whether a new patch which had been put on the dome leaked. The steam was then high, but it did not leak of any consequence. James Barron states that when he and Patterson got on the engine the steam was escaping rapidly from this patch, and he thought it too high, for *it was very blue*. He did not, however, at the time, consider it dangerous. Neither Barron nor Davis knew anything about the condition of the safety-valve, and they have no recollection of hearing the steam blowing off at the valve.

"Mr. Power, the superintendent of the road, believes that the valve was screwed down by somebody while the fireman was at breakfast, during which time the engine stood on the track, fired up and waiting for the train, with nobody to look after it. This is, however, mere surmise; the injury to the valve preventing any conclusions as to its condition. The safety-valve was two inches in diameter, and the scale of the spring-balance would not indicate a greater pressure than 130 pounds to the square inch if screwed down as far as it would go.

"In conclusion I will remark that the cause of this accident is more manifest than in any explosion I have had occasion to investigate; the evident flaw at the flanch of the flue-sheet, and the fracture of the stay-bars rendering an explosion almost inevitable, if any accident or carelessness should produce an unusual head of steam.

"What can be said of the policy which compels the use of locomotives in such a condition as this? for there is good reason to believe that several others are in the same dangerous state. The number of these machines on the Portage is entirely insufficient to convey the traffic upon it with economy and safety; all of them have been many years in use, and many of them are engines which had been used on the Columbia road until antiquated before being transferred to the Portage.

"Very respectfully,
"Edward Miller, C.E.
"Pittsburgh, Pa., June 10th, 1847."

A resolution of the board of Canal Commissioners, dated June 2nd, 1838. directed that two engines be fitted to the use of anthracite coal as soon as practicable, pursuant to which a series of experiments was commenced, which were stated by A. Mehaffey, superintendent, Philadelphia & Columbia Railroad, in his report of that year, to have "produced the most gratifying result." The plan first tested was "to attach a fan to the front of the boiler of one of the locomotives, and thus create a draft. This, together with some trifling alterations in the engines, promised, in theory, to answer a good end, but when brought into practice was found insufficient to keep up the fire at all times and under all circumstances, as the fan could be put in requisition only when the locomotive itself was in motion." This having failed, the master mechanic, Mr. Brandt, suggested placing a fan of a different construction, immediately in front of the ash pan, and driving it by a separate engine. An application of this arrangement was accordingly made, the engine having a cylinder of a 4-inch bore and 8-inch stroke and being placed on the left side of the boiler.

The performance of the locomotive thus equipped was, according to the report, very satisfactory, stress being laid upon the fact that the blower was available whether the locomotive was standing or moving. The report makes the following statement as to the performance of the locomotive, the name or builder of which is not, however, mentioned:

"The quantity of coal consumed from one plane to the other (distance 77 miles) with a train of twenty or twenty-five loaded cars, is about one and a half tons, at four and a half dollars per ton, retail price. A train of the same weight would require two cords of oak wood, the average price for which, cut and split ready for the engine, is four and a half dollars a cord, thus showing a gain in favor of the coal, thirty-three per cent. Besides, coal enough can be loaded on the tank at Columbia, to carry the train to Philadelphia, without the loss of time and cost of labor, consequent upon stopping and loading wood about every twelve miles.

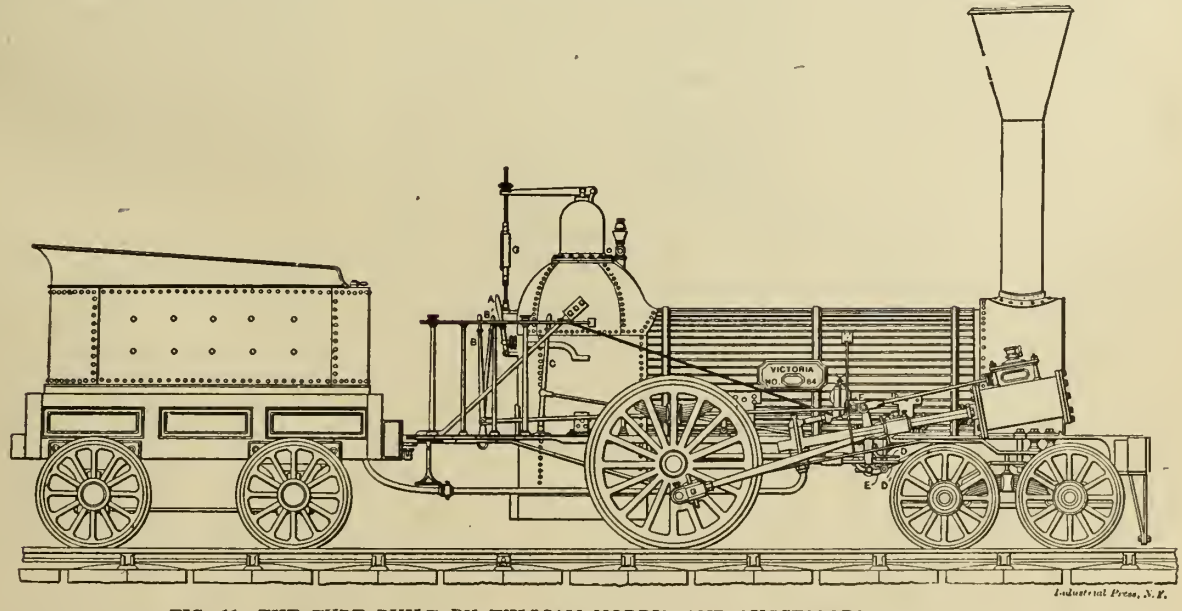


FIG. 11—THE TYPE BUILT BY WILLIAM NORRIS AND SUCCESSORS

"The locomotive above described is now performing her regular work from day to day. Another on the same plan will be ready in the course of ten days." The Canal Commissioners' report of October 31, 1839, contains that of James Cannon, then superintendent of motive power, in which he mentions the purchase of three locomotives, built by Henry R. Campbell, of Philadelphia, costing, with tenders, $7,500 each, of which he says that they "are machines of the very highest order. They weigh thirteen tons and combine great strength and power with beautiful finish. Their performance has fully equalled all my anticipations." He also refers favorably to two locomotives built by D. H. Dotterer & Co., of Reading, and to the purchase of an engine with vertical boiler, which had been placed on the road nearly a year before by Ross Winans, a similar engine being daily expected. He then refers to the experiment made by "the late superintendent" (Mr. Mehaffey), in the burning of anthracite coal, as to which he says that it "did not succeed and was abandoned before the undersigned took charge of the road." He then describes the plan in use under his supervision as follows:

"The plan now in use is a very small rotary attached to the bottom of the boiler which is driven by a small quantity of steam taken from the dome. The fan is enclosed in an iron casing from which the air is conducted through a funnel to a perfectly tight iron chest, which encloses the whole of the ash pan. The air being forced into the chest, it is constantly working itself through the fire by the power of its own pressure and thereby keeps up a constant blaze, and an amount of heat equal to all its purposes. This fixture was first tried upon a new engine called the 'James Clarke,' one of Mr. Baldwin's first-class machines. It has been making its regular trips for about six weeks, and as yet has given no sign of a failure. It has drawn very heavy loads at every trip and has done its work with more apparent ease than when wood was used upon it as a fuel. As a test, the coal was weighed one trip. The engine drew twenty-two loaded cars, or one hundred and twenty-one tons, and consumed one ton and a half of coal, and had it been of the purest quality and well selected, the trip could have been made with a ton and a quarter, costing about seven dollars and twenty-five cents, while the same amount of freight, drawn by the same engine, would have required two cords of wood, which, including cording, cutting and splitting, costs about eleven dollars. This coal is from the Pottsville mines, and it is the only anthracite which we have yet found to answer the purpose. I may also state that there is other coal of a similar quality, as convenient or more so, that will probably answer as well upon trial.

"There are now five engines upon the road which are propelled by steam, generated with anthracite exclusively, and it is believed that by the first of January all the heavy engines on the road will be ready to use it.

"Numerous experiments have also been made in the use of bituminous coal. This, when it can be had of a pure quality free from sulphur and in masses large enough to prevent its falling through the grates, has been found to answer admirably by a very simple alteration of the grate bars. Four engines are now using it exclusively. Two are employed in drawing the day lines of passenger cars, and two on the night lines of passenger and freight cars."

In the annual report of the commissioners, January 15, 1841, Mr. Cameron says that the engine contracted for with Ross Winans is similar in principle to the previous engine, but entirely different in its proportions, and adds: "It is intended exclusively for the transportation of heavy trains of burthen cars. It will haul double the ordinary train, but, owing to its great weight, must be run very slowly over the road."

Prior to the above experiments on the Columbia Railroad, anthracite coal is stated to have been burned successfully on the Baltimore & Ohio Railroad, in the "grasshopper" and "crab" engines of Ross Winans, with vertical boilers, the fire-boxes of which did not have a greater area than those of the engines of the Columbia road. In the Winans engines, the fan was operated by a rotary engine worked by the exhaust steam so that they were subject to the objection, noted in Mr. Mehaffey's report, of being inoperative when the engine was standing, although this does not appear to have impaired their performance. In view of the successful results in burning anthracite coal, reported by the two superintendents of motive power of the Columbia road, it is remarkable that the use of this fuel was not continued, but this does not appear to have been done.

The substitution of a motor-operated fan for an exhaust blast, as a means for creating the necessary draft in a locomotive fire-box, which had been practised prior to the year 1834, has latterly been the subject of consideration by engineers of acknowledged ability in the design of locomotives, and a number of designs for the application of the principle have been proposed. So far as the writer has been able to ascertain, none of these has gone into actual service, but the principle appears to be a correct one, and results of practical value may reasonably be expected from its development.

The haulage of the sectional boats constituted a considerable portion of the service of all the locomotives which have been referred to, and while such haulage also formed part of the service of the larger and more powerful locomotives which superseded them, it was not continued for a very long period in the later engines. The consideration of the original and following early motive power which has been herein presented, would, therefore, seem to be sufficient in connection with the general subject—sectional boats.

The importance and value of inland navigation upon canals and canalized or deepened rivers has for a long time been fully recognized, and large expenditures, both governmental and private, have been devoted to its development. Economical considerations have determined that the dimensions of vessels most desirably adaptable for service in such navigation, should be such that they would not be capable of haulage over railroad track. It is, consequently, while not impossible, altogether improbable that the system originated in the United States of transferring freight without breaking bulk over a line of alternate links of railroad and canal, will be reproduced in the future. Nevertheless, it is not too much to say that Canvass White's conception, nearly a century ago, of such a system, rises to the level of engineering genius, and the practical development of that conception into successful operation by his successors, the leading features of which, so far as information was obtainable, the writer has endeavored to present, evidence those who participated in it to have been sufficiently able and ingenious mechanics, and energetic operators, to merit that a record of their achievements should not be omitted from the pages of historical technical literature.

NEW CATALOGUE

The Saint Louis Machine Tool Co., St. Louis, Mo., have issued a new catalogue dealing with their line of machine tools. This catalogue is known as No. 16. Their varied line of grinding, polishing and tapping machines are shown by many illustrations and full data are given relative to each style of machine. It is also stated that safety collars are provided when called for. Roughly speaking some 25 pages are used to display this line.

NEW CATALOGUE

The Graton & Knight Mfg. Co., Worcester, Mass., have issued a very interesting book dealing with their lines of standardized leather belting for power transmission. This bulletin is numbered 101, and is done up in very attractive style. The book consists of almost 100 pages and is well illustrated throughout.

After the various lines have been discussed and their qualifications stated, the remainder of the book is filled with real live information for anyone using belting. Data of considerable value is given, in fact the latter portion of the book is a small text book in itself.

W. M. David, of the firm of Baines & David, Toronto, together with Mrs. David, is on an extended trip to Wales.

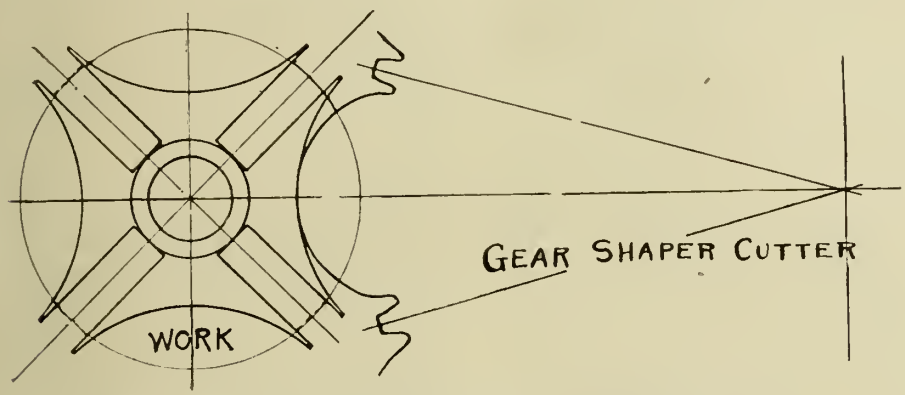


WHAT OUR READERS THINK AND DO



ANSWER TO PROBLEM

On page 398 in our October 28th issue, we published an article dealing with a problem in machining a Geneva movement for using in a moving picture machine. This problem seems to have aroused considerable interest, for we have so far had several replies to the query.



HERE IS ONE SOLUTION TO THE GENEVA MOVEMENT PROBLEM

The first of these is published below.

The Fellows Gear Shaper Co., Springfield, Vermont, on reading of the problem, decided it was up to them to state their opinion on the matter, and as is well known, they are well able to speak on manufacturing problems. To our mind, they state, this problem should be solved as follows:

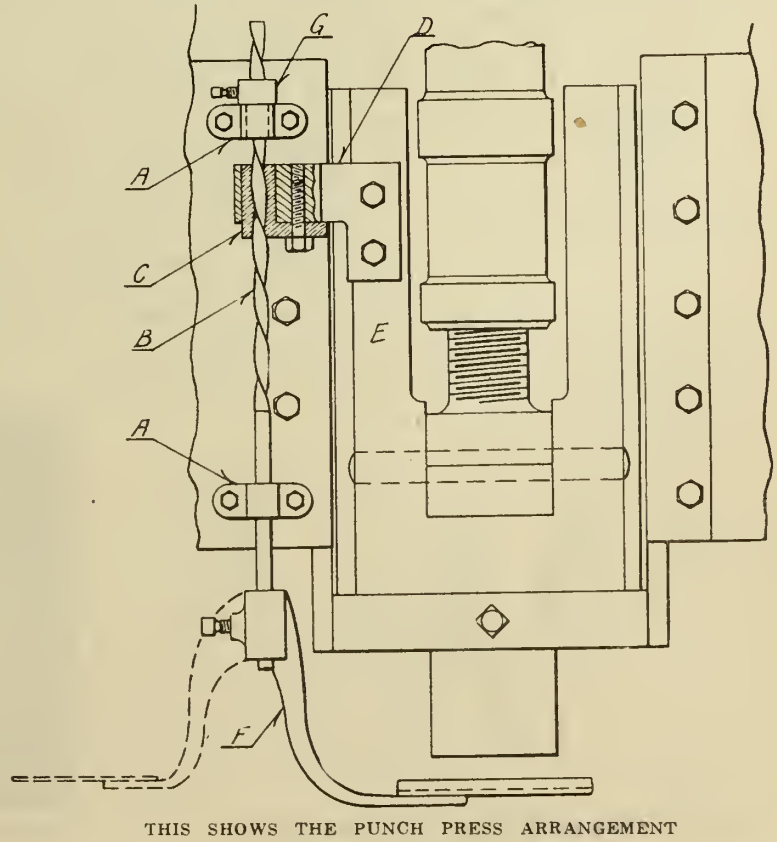
We presume that the difficulty encountered by the manufacturer in producing this Geneva stop mechanism is due to the curves indicated by the 29-64 radius and the location of the slots. It is almost impossible to mill four curves and have them all accurate, even though the cutter itself is accurate. This is due to the great difficulty of accurate indexing.

In our experience we have had a lot of irregular shapes to produce on the gear shaper, and a suggested method for handling this would be as follows: A cutter could be made which would accurately reproduce all four curves and at the same time cut part way into the slots, thus locating them. Then it would be a simple matter to finish the slots to depth with a milling cutter. The sketch accompanying this suggestion is self-explanatory as it clearly shows the outline of the proposed cutter.

PUNCH PRESS ARRANGEMENT

J. W. Rodgers

A handy arrangement for catching the finished product of a punch press is shown in the accompanying sketch. This particular device was operating on a washer press where the washer was blanked out in a duplex die and the finished washer carried up in the punch, from which it was ejected as the ram reached its top position. The two brackets A, A were secured to the stationary portion of the press in such a position as to allow free movement for the operating shaft B. This shaft is of square section and twisted or milled on the upper half of the length for operating in the nut C, the latter having a lug at one side for fastening to the bracket D, which is secured to the ram E. To the lower end of the rod B the bracket F is secured, and this bracket carries the pan that is swung under the punch as it comes to its top position. The swinging piece may be adjusted to the desired height by means of the collar G, the lower portion of this collar being turned to fit the bore of the bracket A.

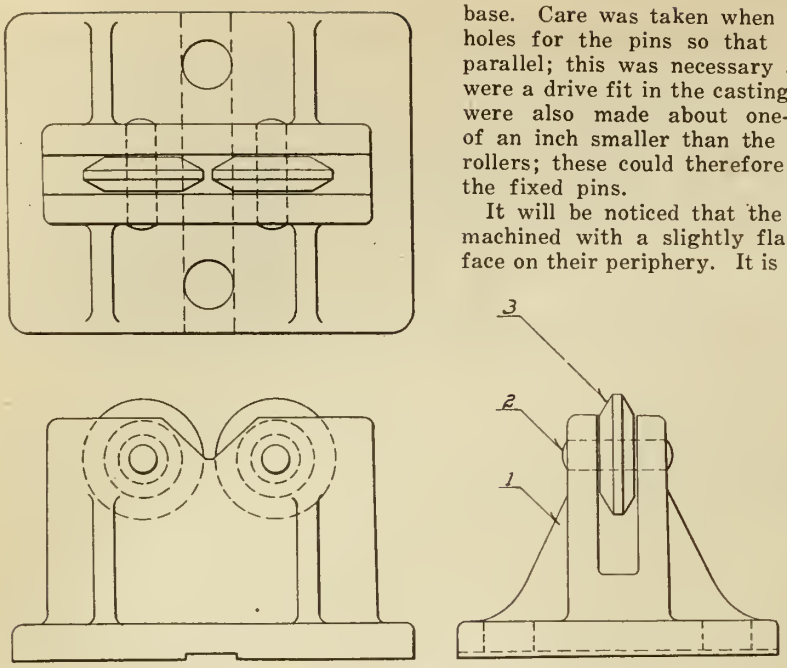


THIS SHOWS THE PUNCH PRESS ARRANGEMENT

TOOL ROOM ALIGNING V-BLOCK

By Robert Mawson.

A fixture that is practically necessary to any department where accurate tools are made is some type of aligning device. Before elements such as shafts,



GENERAL ARRANGEMENT OF THE BLOCK

studs or pins can be machined with shoulders or keyways, it is absolutely necessary to know that these parts are parallel. This is more so when such pieces fit the entire length or operate in bearings or bushings. If the least bend or misalignment were in evidence, it is obvious that the piece could not turn on its axis.

Of course a shaft could be tested in a lathe, but this would entail centring, which is an expense; and further, the process of testing would mean the use of a machine tool. The lathe is prevented from performing some other machining operation, therefore such procedure entails a double expense, unnecessary centring, and use of the lathe. To obviate this the tool shown in the illustration was designed and has been used successfully not only in our tool room, but also in the machine shop. The base (1) is made of cast iron, and is 5-in. long, 4-in. wide, and was designed with such generous proportions so that the tool would rest squarely under any desired condition.

The vertical walls of the base are provided with ribs so that the castings will not distort when in service. Two hardened tool steel rollers (3) 1½-in. in diameter are held by means of steel pins (2) in the vertical walls of the tool base. Care was taken when drilling the holes for the pins so that they were parallel; this was necessary as the pins were a drive fit in the casting. The pins were also made about one-thousandth of an inch smaller than the hole in the rollers; these could therefore revolve on the fixed pins.

It will be noticed that the rollers are machined with a slightly flattened surface on their periphery. It is well known that a perfect knife edge is the ideal condition for an aligning block roller, but when such a tool is employed for heavy or frequent use, it would prove impracticable, as the hardened sharp edge would soon be damaged. The roller as designed, therefore, provides us with a tool of lasting service and proves accurate enough for any purpose demanded in the tool room or machine shop.

By referring to the illustration it will be seen that two slots have been machined in the base, one at right angles to the other. These slots are employed to accommodate tongues of the proper width to suit slots in a milling machine table or any other machine tool. When the device is used in this manner, two of them are placed at the proper distance apart, to suit the element being tested. The V-blocks may then be fastened to the table, holes being provided in the base to accommodate such mediums. It is then a simple operation to test the part resting on the rollers, using an ordinary dial or other type of indicator. Revolving the piece around will show by means of the indicator if it is out of alignment and how much the error is. The element, when necessary, is then straightened in the usual manner and further tests made until the desired results are obtained.

REPAIRING OF BOX CHUCK WRENCHES

By Harry Moore

No attempt is made in this article to give instructions on the manufacture of chuck wrenches, but merely some instructive notes to the mechanic who may have one to repair occasionally.

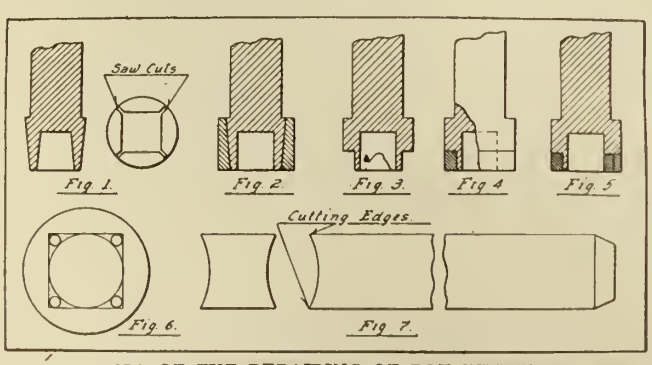
After a chuck wrench has been used for some time it will, as a general rule, have worked itself bell mouthed, and the moment you try to tighten with it will slip off the chuck square. A good way to make a permanent repair in such a case is to turn off the upturned edge to a slight taper as shown in Fig. 1.

The corners of the square are next slotted down with a hand saw to their full depth. A piece of machine steel is now bored out to fit the taper on wrench, and hammered on until the square is its original size once more. The ring is then faced off and turned, completing the job as shown in Fig. 2.

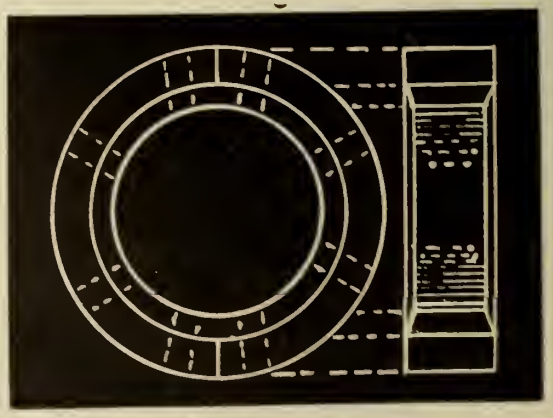
Hardened chuck wrenches do not give the same trouble with regard to wear, but as they are generally made of thinner stock, a piece will sometimes break entirely away. These wrenches are invariably a fairly close fit in the circular hole in chuck, therefore, a slightly different procedure is necessary in making a repair. The wrench is first of all annealed, and if the broken piece can be found it is sweated into place. The wrench is then turned as shown in Fig. 3. A machine steel ring is made several thousandths smaller, then shrunk on, the completed repair being shown in Fig. 4.

If the broken piece is not at hand the wrench is filed, or ground, and a piece made to fit as at Fig. 5, when the procedure is as before. The making of a chuck wrench is a comparatively simple matter if tackled in the proper manner. Very many mechanics fail to make a good job for two reasons: First, they leave too much stock for the punch to remove; second, they endeavor to force the punch in order to remove a lot of stock at once. The result in the first case is that the punches are broken, and in the second case, jagged, uneven holes are procured.

A good method for laying out a wrench



THE DETAILS OF THE REPAIRING OF BOX WRENCHES



BROKEN CAST IRON ROLL—HOW THE REPAIR WAS MADE

preparatory to drilling, is shown in Fig. 6. The four small holes are drilled first, then the large centre hole (which should be slightly smaller than the width of square) is drilled to the same depth. This method leaves very little stock for the punch to remove. This punch is made as shown in Fig. 7.

It will be noticed there are only two cutting edges on the punch. By making it this way a proper rake can be ground on the end which is impossible in the case of a punch with four cutting edges. It is placed on the lines at one side, driven home, then placed at right angles to complete the hole. It will be found that such a punch requires only a few light taps and leaves a clean, square hole.

MECHANICAL REPAIR ON A BROKEN CAST IRON ROLL

By W. S. Standiford.

In every mechanic's life emergencies will arise that call for rapid thinking and original work on his part in order to keep the wheels of industry running smoothly, as machinery breakdowns will happen in all factories and mills at the most unexpected times. In this article the writer shows how he made an emergency repair some years ago, on a broken roll, that lasted until the roll was worn out. When a bar of iron was going into No. 2 pass, a sliver on it jerked the tongs from the hands of roller, the tongs being jammed between the side of bar and the collar separating numbers 2 and 3 grooves; the result being that an eight-inch long section of collar was broken out. Owing to the conditions of the country, welding supplies were unobtainable, a new cast iron roll could not be gotten in less than three weeks, it taking four more days to make a new roll out of it.

As the company was anxious to get their rolled bars out on time, the writer was delegated to see if a mechanical repair could be made, provided it were possible to make it withstand the enormous side pressure exerted by the iron during rolling. A patch the size of the broken section and screwed to the roll was first thought of and decided to be impracticable, as both joints being near one another, would cause the patch to spring and shear off some of the metal on the bar.

I finally decided to turn the cast iron collar off of the roll altogether and replace it with a wrought iron one, the joints of the two halves being a long distance apart would enable the collar to withstand the spring when a bar was entered in the pass. In order to make the collar as rigid as possible under the circumstances, a slot having a slight taper and 2½ inches deep was cut into the roll, the width being 2¼ inches. After the slot was turned, a wooden templet was made, the length of the two halves were ascertained by the "cut-and-try" method, until when placed in the roll groove opposite one another, the wooden collar made a very snug fit, at the joints and bottom of groove. From these templets a wrought iron collar was forged by a blacksmith, put in lathe and turned with a taper matching the slot; the tapered section being a few thousandths of an inch larger so as to make a force-fit in the slot. One half of the wrought iron collar was forced into the slot as far as it would go, by the careful use of hammers, a heavy iron ring was then put over the half collar and four jacks, one opposite each joint, and the others being spaced equal distances apart. Part of the ring on the opposite side of the jacks was then filled with iron blocks. The jacks were then screwed up, care being taken to get equal pressure so as not to spring the half-collar, the pressure exerted by the jacks being continued until the collar section touched the bottom of slot. Collar was drilled and tapped to take three-fourths inch thick machine screws that extended one inch into the roll body. The other half of the collar was next fitted, a good job resulting. The roll was then put into the lathe and the collar turned to the same shape and size as the others. When the time arrived to use these rolls in the mill, the writer's heart was, for a few minutes' time, in his throat (metaphorically speaking), but the new collar withstood the heavy pressure admirably, a slight mark on the iron bars produced by the joints being removed in the finishing pass of the rolls. The net result of this repair job was: The company got their contract out on time. Over $300 was saved on a new roll, and the writer received an unsolicited raise in wages. No sketch is shown of the roll as readers are no doubt familiar with a set of rolls, and how they look. Should you not be conversant with the same, look up the issue of Canadian Machinery, July 15th, page 70. The sketch of the collar is self-explanatory.

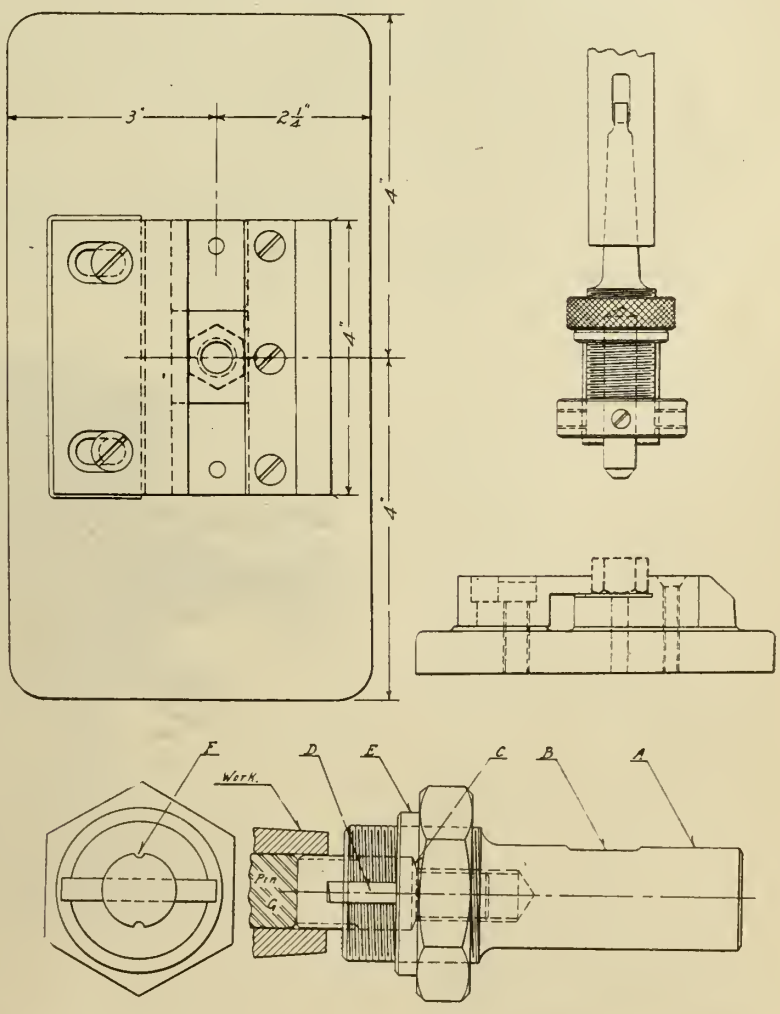
See Page 440

TWO USEFUL FACING TOOLS

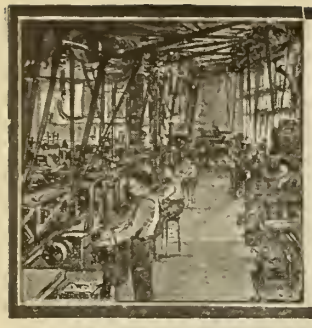
By "Draftsman"

The facing tools described are types that have many applications in the machine shop. They are intended for use on vertical drilling machines, but may be similarly used on horizontal boring machines. Fig. 1 shows a tool for facing the rim around a previously machined hole. The steel body A fits into the socket of the drill spindle and is secured by a set-screw bearing on a flat B. The centre of the outer end has a hole of two diameters, the inner one being threaded. Into this fits a tool steel pilot which is centred by the bevelled shoulder C. A slot through the pilot and across the end of the body carries the cutter D, whose projecting faces are backed off right and left. The outside of the body is threaded for a hexagon nut which holds the cutter by pressure on an intervening washer E. Two longi-

Cntinued on Page 443



DETAILS OF BOTH FACING TOOLS



DEVELOPMENTS IN SHOP EQUIPMENT



BRASS FURNACE OF NOVEL DESIGN

Metallurgical and chemical engineers for a considerable period of time have been endeavoring to solve the question of melting brass and other non-ferrous metals in the electric furnace in the most efficient and economic manner, realizing as they have that there was no question of higher production when melting electrically so long as certain metallurgical features of the process could be properly overcome. As a result of considerable research work, single-phase and even two-phase electric brass furnaces have been designed and put on the market, some of which seemed to solve the question of melting these metals electrically. It has, nevertheless, been a desire of those interested that a three-phase unit might be developed which would do the melting more efficiently and economically, and it will be interesting to engineers in the metallurgical and electrical field to know that such a furnace has been marketed.

The Volta Manufacturing Company, Limited, Welland, Ont., have had their engineering staff at work for some months past developing a three-phase electric brass furnace along the lines of what they considered would be the most efficient piece of apparatus to meet the requirements of the brass and non-ferrous metal industries, and have now put on the market a three-phase electric furnace which they claim is superior to anything heretofore developed for this class of work.

As will be seen by the illustrations of the furnace, the shell is of cylindrical design and is operated in an upright position—similar to the electric steel furnaces. The furnace is lined with refractory brick and the roof is also made of refractory material. It is provided with a cast iron base equipped with a motor-driven set of gears and rollers, which gives to the furnace a natural gyratory movement.

One of the strong features is that it is a three-phase unit, which means a balanced load on the lines of the power company and consequently a better power rate for the operator. It is quite generally known that many power companies, having a limited amount of power on their lines, do not desire and will not permit the operation of a single-phase unit on their lines except at a very high rate. On account of having three electrodes it is not necessary to maintain the same degree of perfect alignment of electrodes as is necessary with the single phase unit in order to maintain a high degree of efficiency and inasmuch as the arcing takes place between the three electrodes the arcing is distributed over a much wider area than in the single phase two-electrode furnace, consequently better melting facilities are provided.

As shown in the photographs, the electrodes enter the furnace through the side of the shell at points 120 deg. apart. Graphite electrodes are used and are supported on heavy cast iron arms which are provided with guides to take the electrode holder. The construction of these arms provides a substantially insulated sleeve around electrode, which is kept cool by means of a water-cooled collar. The latter is in the form of a ball point, and by this arrangement the position of the electrodes can be changed relative to each other, at the same time making provision so that they can be lowered or raised in respect to the metal bath.

The electrode holders move in the guides provided in the cast iron arms. This movement is obtained by means of heavy screws actuated either by hand or through a simple system of motor-driven gearing. The charge, as will be noted, enters the furnace below the electrodes, and it is not necessary to withdraw the same from the furnace at any time, either during the charging or pouring period. This eliminates any chance of electrode breakage due to the heavy scrap falling on them. It gives a longer life to electrodes and also eliminates the loss of time and the expense ordinarily incurred in removing and replacing the broken ones.

The roof of furnace is independent of the shell. This permits of the relative height of the roof to the bath being designed in such a manner as to insure the best melting conditions as well as the least possible fusing of the refractories. A vent hole with a light cover is provided in the roof of furnace which allows operating under tight conditions with perfect safety. Should gases, formed from the use of oily or dirty material in the charge, reach a certain pressure, they are allowed to escape through this vent in the roof.

In actual practice it has been found that the heat from the arc is sprayed down and over the metal in such a manner as to heat the whole surface of the metal evenly. The effect of this is very important as it reduces the volatiliza-



NOTE THE BASE AND ROLLERS WHICH GIVE THE FURNACE THE GYRATORY MOVEMENT



GENERAL VIEW OF THE FURNACE. NOTE THE MOTOR AT SIDE

tion losses in the metal being melted to a minimum, and the linings, not being subjected to any high temperatures, last much longer. The motion given to the furnace by means of the combination of gears and rollers, has proved itself to be a very efficient and natural mixing, one by means of which superheating of the metal is practically eliminated.

This furnace has been subjected to some very severe tests and is said to have proved itself an efficient and economical melter, very simple of construction and easily handled. When running on yellow brass, metal has been produced with a current consumption as low as 225 k.w.h. per ton of metal produced, and when running on aluminum-bronze the current consumption averaged about 300 k.w.h. These figures were not taken at a time when the furnace was operating continuously and it is only reasonable to expect that the power consumption will be considerably reduced when the furnace is thoroughly heated and is being operated continuously. At the present time the manufacturers are producing these furnaces in the following standard sizes: 500 lbs., 1,000 lbs., and 2,000 lbs., having a transformer capacity of 125 kw., 175 kw. and 300 kw. respectively.

EVER-HOT SOLDERING IRON

The Peterson-Plummer Manufacturing Company are now making an ever-hot soldering iron which is light in weight and a convenient size for every requirement. The gasoline is contained in a reservoir in the handle which is made of seamless brass tubing, the pump being located at the outer end. The flow of gasoline is through cotton wick contained in a rustproof iron pipe between the handle and the burner. The burner is so designed that it may be used effectively in any kind of weather or high winds. The iron is fitted with one large and one small point.

TWO USEFUL FANCY TOOLS

Continued from Page 441

tudinal grooves F in the pilot gather any grit that may pass.

When in use the cutter removes metal until the pilot bears on the top of the pin G, on which the work is mounted. The tool may be reground many times and its cutting edges will always be the same distance from the end of the pilot, thereby uniformly limiting the cut.

In Fig. 2 is shown a lighter type of tool for facing black hexagon nuts in the simple adjustable jig. Here the body fits into a tapered socket and the nut is knurled. The pilot hole is of one inch diameter, and the threaded part of the body has two through slots for the separate cutters. The latter are held, at the lower end, by a collar with two grub-screws at right angles, and this also pinches the pilot. At the upper end each cutter is retained by a bevel engaging that of the thick washer.

Such a tool has quite a long life before the cutters need to be renewed.

NEW THINGS IN MACHINE TOOLS

MULTI-SPEED GRINDING MACHINE

A grinding machine that is very suitable for both production or tool-room work has been placed on the market by the Wisconsin Electric Company, of Racine, Wis. The device is provided with a set of interchangeable spindles and pulleys, so that a wide range of speeds is obtainable. Dust-proof ball bearings are fitted to the spindle. The device can be swiveled to any desired angle for every class of work.

TOOL GRINDING MACHINE

A motor-driven ball-bearing tool-grinding machine, fitted with a quick make and break oil switch, is now being manufactured by the Ransom Manufacturing Company, of Oshkosh, Wis. A starting pedal is placed at either side of the base of the machine, and when the foot pressure is released the machine is automatically stopped. Self-aligning S K F ball bearings are fitted to the spindle. The machine is operated by means of a 3-4 h.p. General Electric motor.

QUICK-ACTING MACHINE VISE

The Nelson Tool & Machine Company of Bloomfield, N.J., has recently brought out a new machine vise, and it is claimed that no hammer is needed in bedding the work on the vise bottom or to the parallels. The operating screw is set at an angle so that when pressure is applied the sliding jaw shows no tendency to lift upwards. The vise is made in two sizes, six inches wide by two deep and opening of 5 3-4 inches, and four inches wide by 1 1-2 inches deep, with opening of four inches.

IMPROVED ABRASIVE DISK

An improved type of abrasive disk for use in disk grinding has been placed on the market by the Gardner Machine Company, of Beloit, Wis. The construction of these disks increases the efficiency in grinding operations. The thickness is double that of the ordinary glue-bond disk, the bond being a special cement that powders away during the grinding operations. The corrugated surface causes the abrasive grains to assume a better position, always presenting new cutting points to the work.

DRILL RACK

The Peerless Machine Co., Wis., have placed on the market what is known as a gauging drill rack. This rack provides a place for drills, and each drill that is in the rack has been accurately gauged and must be in the correct place. This rack provides a practical gauge for all sizes of drills and reamers ordinarily used in any shop, large or small. In highly organized shops these racks are often installed in the tool crib where one rack may be used exclusively as a gauge while another series of racks are used to take care of the different tools.

In small shops these racks are sometimes attached to the drill press, and a complete set of drills maintained at the machine tool. This rack is claimed to meet a need which has long been apparent in all shops, namely, on account of tools slipping in the chucks, the numbers indicating the drill sizes are soon destroyed or badly blurred, and a practical gauge is desired to eliminate errors and save the time lost in securing a micrometer or gauge.

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Quoting New York Funds

SOME weeks ago this paper, in an interview with J. Vernon McKenzie, formerly trade commissioner at Glasgow, referred to the fact that some Canadian exporters were asking for payment in New York funds. He explained that there was marked resentment to this practice on the part of many of the Old Country firms, the latter holding that Montreal quotations should be sufficient to cover the situation.

An Ottawa despatch this week refers to the same practice, complaint being made that trade commissioners are finding decided objection to this system, which they regard as trying to pinch off a little extra from the buyer.

One section of the Ottawa despatch points out that Canadian Trade Commissioners in every part of the British Empire state that general indignation is expressed by importers that Canadian firms almost invariably collect for goods exported in United States funds. Latterly the complaint has been that Canadian steamship companies also collect for freight on such goods in United States funds. One Trade Commissioner reports a British merchant as saying, "You keep asking us to give a preference to Canadian producers when buying because it is a British country. Why should I do that when Canadian exporters always ask us to pay in United States funds? Are we to believe that Canada is only a commercial adjunct to the United States? It looks so to us when such things happen."

Much of the material that some Canadian manufacturers use is bought in the U. S. market, and paid for in New York funds, but no doubt provision is made for this in fixing the selling price. Unless there is some very good explanation to be offered on behalf of the Canadian manufacturers adopting this practice, it will be charged that they are taking undue advantage of a passing situation, and in so doing injuring their reputation to a very serious degree, all of which will be hard to overcome in the future when goods are plentiful and orders badly needed.

Investing in New Machines

A STORY comes from Hamilton telling of the demonstration given to the civic authorities of a new mechanical excavator. The machine cost $10,000 or so, and, naturally, the civic officials wondered if they were going to get that much real value for their money.

After the machine was seen in operation it was estimated that forty men would be required to keep up with it, and one of the controllers remarked, "People criticized the spending of this much money on a piece of machinery, but this proves to me that it was a wise investment."

That same situation comes up a good many times in a good many places. Firms look at the amount of money that they will have to pay for a new machine, and they keep on looking at that sum until it grows into a foothill or a mountain.

They do not look on past that obstacle to see what is on the other side in the way of greater production and better work. They have an old machine, and by some strange process of mental juggling they think every extra day's work they take out of the carcass of that old thing they are just that much ahead.

The amount that can or should be spent on a machine can be safely judged by what that machine will do. If it can produce sufficiently in excess of an existing tool to pay its way and then some, why not let it?

There are cases where an old machine is humping along, causing the man who runs it considerable trouble and loss of time, putting the shop "up against it" if that man happens to be off for the day—and yet they imagine they are getting easy money by not having to go into the machine tool market and replace the old tool.

And once they get into the market and buy the new machine, put it in line and see it perform, watch the production records and compare them with the best limpings of the old tool—well, as the civic officials in Hamilton with their excavator, they are convinced that it was a good investment and a money maker right from the start.

You can save money in more certain ways than by hanging on to your old equipment.

Sessions of the tariff commission convince some critics there is no connecting link between farmers and manufacturers. Is that so? How about pig iron?



—Knott in the Dallas "News."
The Optimist.

Poor Insulation or a High Tension Spark

There are certain mechanical laws that must be conformed with in any line of activity. When some or any of these are violated, there is going to be trouble. A recent case occurred at Buffalo, where a number of men were cruelly burned, most of them fatally, when new apparatus in a generating station went wrong. We asked T. H. Fenner, the editor of Power House, to discuss this matter, and in the following he has done so.

THE generation of high potential electric current and the transmission of it over many miles of country is attended by comparatively few accidents in proportion to the amount of electrical power development. The chief cause of fatalities through high voltage electric lines is by the coming into contact with them of linemen engaged in their usual work of running new lines, and repairing and locating faults in existing ones.

Accidents in the generating stations themselves are happily few in number, and fatalities even less, and with the constantly better efforts towards safety that are being put forth, the number should steadily decrease. It is therefore with something of a sensation of horror that we read of the destruction of no less than eleven men, almost instantly, through an accident, which, although it may have happened before, does not recur to our memory.

The accident in question was the explosion by some fault in the insulation, presumably, of the oil used for the cooling of a transformer in the Tonawanda power house, Buffalo. The change of electric current, which is generated at high pressure, to current at a much lower pressure is accomplished by means of transformers which consist of two separate coils of wire wound on iron cores. The high potential coil will consist of a large number of turns of small wire and the low potential side of a less number of turns of a larger wire. The effect of the high potential current being passed through the high potential coil is to induce a current in the low potential coil of the same periodicity, and the relation between them is such that if the high side A consists of 50 turns, and the voltage is, say 100 volts, then if the low side consists of 25 turns the voltage in that coil would be reduced to 50. This, of course, applies to any voltage, and any relation of the number of turns. There is little loss between the two sides, by which we mean that the product of volts and amperes in the low side will be almost the same as that of the volts and amperes in the high side.

What loss there is appears in the form of heat, and in order to carry off this heat, it is usual to immerse the whole apparatus in a bath of oil. This oil in turn has very often coils running through it which carry a circulating stream of cooling water, and thus the heat is effectually dissipated.

It was the bath of the oil that exploded and thrust forth a sheet of flame which licked out the lives of eleven men in an instant. The cause of the accident is stated to have been a short circuit. The apparatus was under test at the time, and it is probable that the oil bath had been raised to a dangerously high temperature without it being noticed.

A piece of defective insulation and a high tension spark would easily supply the little extra heat necessary to cause the flash. No doubt the enquiry that will follow will throw light on the exact cause of this sad accident, and make the recurrence of it extremely unlikely in the future.

A Buyers' Market Here

HERE is the opinion of a man whose business it is to watch the markets. T. F. Bentley, writing in a recent issue of "The Purchasing Agent," says:—

"There is a definite downward trend in all commodities and in all countries. Prices are not declining because of the election campaign, or because it is harder now to get funds for speculative purposes than it was a year ago, but because business is gradually getting on a healthy basis—that is, we are coming again into a "buyer's market," which will be better for general business. A buyer's market means that the buyer may require definite information as to the price he must pay, not only for immediate needs, but for a reasonable time to come. It means that the buyer may demand reasonable assurance that the goods he agrees to take and pay for will actually be delivered and will not be diverted to some other point that may offer a trifle more payment. Finally, it means that the buyer may insist, within reasonable limits, that specifications of quality be carried out."

What's the use of having your trousers creased, boots shined, clean shave, clean collar and latest tie, fine line of talk about the weather, politics, reduced prices, Bolshevik, League of Nations, if you can't succeed in getting the customer's signature on the dotted line?

What the Business Papers Say

"Marine Engineering."—This is a plea for greater frankness on the part of engineers and manufacturers, as a matter of policy for their own advantage. There is a very proper idea that a man may well keep his private business to himself and that corporations may well practice a like reserve. But when a man wants to sell something it at once becomes a matter of business to the purchaser. There are, of course, instances in which the purchaser may well use his purchase without too much curiosity; the average man had best wind his watch regularly and think no more about it till he wants to know the time. But usually a machine needs intelligent care, and the more the user knows about it the better service he will get from it.

The Changing Foundry Aspect

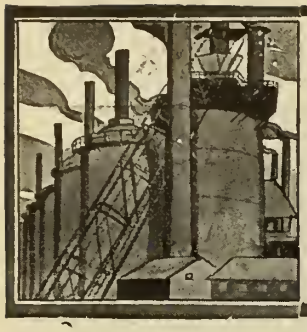
"The Foundry."—During the past two weeks the shift and readjustment in foundry conditions has been most rapid. For a short time previously a decrease in demand in most lines had been noted, and in some directions this even had taken the form of cancellations of existing contracts for castings. To-day the cycle has swung entirely around until with few exceptions a buyers' market for castings governs, and some shops are taking on work foreign to that which they have followed for the past two years in order to keep their forces engaged.

What Determines Selling Price?

"Iron Age."—"In the textile trade and in others in which the ultimate consumer buys over the counter of a store, it is true that the declines came first in the raw materials and that wholesale markets underwent drastic readjustment. But the reductions that have been made in retail prices, most of them moderate thus far, were not the result of a decrease in the actual cost of the goods sold at retail. The dealer's stocks had been bought at high prices and were sold at reductions, going in some cases below cost, because they could be replaced on the dealer's shelves at prices considerably below what he had paid for them. Cost did not determine selling price."

Boilers Keep on Exploding

"Power," (New York).—Certain states that have adopted the A. S. M. E. Boiler Code have exempted oil-country and agriculture boilers with the exception of periodic inspections. Undoubtedly in some cases this has been an expediency resulting from political influence and is most unfortunate, especially when it is considered that many of these boilers are of lap-seam construction and are operated by very unskilled labor. Many of these boilers do explode and the loss of life is appreciable.



MARKET DEVELOPMENTS



Price Talk the Market Topic for This Week

Some Reductions Have Gone Through, But the Most of the Firms Have Made No Move Yet—The Scrap Market in Canada Has Been Pruned, But Business is Dull at the Lower Levels.

PRICES and price talk engage the attention of the market this week even more than before. There is a sincere desire on the part of a large section of the trade to get down to a workable basis as soon as possible, but there are very real difficulties in the way, chiefest among these being that costs do not show much tendency toward lower levels.

One maker of machine tools in Canada stated this week that there was very little chance of them announcing a lower price under present conditions, as there was nothing in their cost of manufacturing that was showing a lessening. However this may be, the fact remains that a number of American makers of machine tools have announced reductions to their representatives in Canada, and they are now working on the new schedule. New York is to be the centre of interest this week, and it is generally believed that following the convention of the National Machine Tool Association there will be some announcement, concerted or otherwise, dealing with the price feature. Cuts already made range from 15 to 20 per cent.

Small tools have been reduced in Canada by some ten per cent.

The steel market itself is quieter, but there is still a good deal of business to be secured. Manufacturers are not buying in large quantities, nor have they for some years past. The reasons for this are two in number: (1) they could not get the material if they were able to pay the price, and (2) the price has been too high in most cases to get them away from the hand-to-mouth class. A slight reduction is announced this week in warehouse prices of bar iron, now selling at 5.50 per pound. Most of the bar iron trade is supplied from the Canadian mills.

The scrap metal market went through a severe pruning at the hands of the dealers this week. They cut fast and deep into the lists they had been working on for buying purposes. Whether this decides the matter remains to be seen. A dealer can name his price, but if the seller will not accept it there is still room for an argument. Just now there are only three or four lines that are wanted, and these are scarce, and mostly in the iron and steel lines. Copper and brass scrap are drugs on the market, and business is stagnant.

BUYERS IN MONTREAL MARKET WAITING FOR SETTLED PRICES

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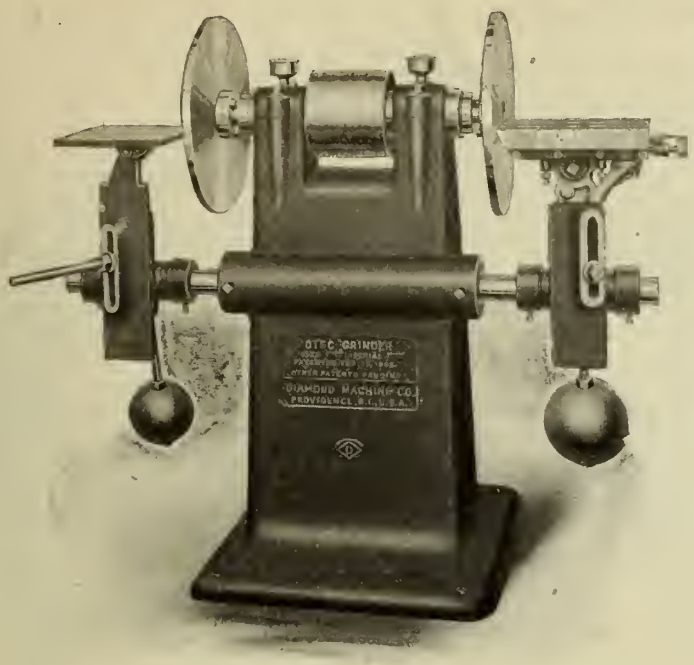
MONTREAL, Que., Nov. 11.—It is seldom now that we hear of mills complaining of a shortage of raw materials for the steady maintenance of plant operations. There are cases still reported where delivery to the mills has been interfered with, but this situation is overshadowed by the more serious one of the declining number of orders being placed on the books, and to the fact that the supply is now equal to, if not greater than the demand. This condition evidently is quite general throughout the steel industry, and is likewise more or less true with all lines of activity at the present time. The interest in the market appears to be influenced by the price adjusting that has featured sales activities on many commodities. The downward trend that marks the movement of materials of nearly every description has acted as a limit gauge by which the majority of buyers are now measuring their requirements. Current purchases are based on urgent needs for immediate consumption, and with declines a factor of weekly or daily occurrence, the place in the sun will be occupied by the seller rather than the buyer. However, this policy of conservatism may be carried to the point where industrial depression would loom up as a serious factor, as present producing costs will hardly permit of continual cutting of material prices, unless something is done to enable the manufacturers to make these reductions without serious loss to themselves. Curtailment in mill and blast furnace operations has been among the recent developments in American steel centers, and in consequence many men have been temporarily unemployed. This action on the part of producers has been found necessary, as it would be inadvisable to continue manufacturing materials at existing high costs when the demand for the product is showing a marked falling off. The movement in this district is steady in character but the volume indicates that requirements are becoming less. Price quotations given last week still hold, but further declines are not improbable.

Prices Unsteady; Demand Light

Weakness and quiet demand continue to feature the metal situation and, with few exceptions, the demand is below normal. The movement of galvanized sheets has shown slight improvement and general distribution is much better. Ingot metals are moving steadily but volume is light, evidently indicating that purchases are made with the idea of meeting the needs of the present rather than the acquisition of material for early future requirements. The prices on all ingot metals are at present unchanged but a further shading is not improbable.

Retrenching Attitude Evident

Dealers here are interested in the possible action to be taken at the meeting now being held in the States by the



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machine tool builders. It is expected that a decision for price revision will be arrived at during the meeting, and the trade will be advised of such action in the very near future. There are many indications of the trade requiring equipment, but the attitude of the buyer today is one of retrenchment in face of lowering prices, and every effort is made to extend the time when the placing of orders for new equipment will become imperative. It is nevertheless true that these placements will ultimately be made, but where a few short weeks may mean a substantial saving in tool cost, the user is evidently content to weather the present storm of uncertainty and inconvenience in order to effect the saving that would result by the reduced cost of the new tools. On the other hand, the slackening of trade, that already shows on the horizon, may spread to many quarters and minimize the necessity of the manufacturer to purchase the equipment which, apparently, a few short weeks ago, was so urgently needed.

Low Prices No Inducement

The old material situation still dwells in a listless atmosphere. as the buying at the present time is exceptionally quiet. What trading is carried on is largely that of local movement in supplying foundries with regular requirements. Even here it is reported that demands are less insistent than formerly. The industrial situation generally offers little inducement for the absorption of scrap for future consumption, and with the uncertainty that continues to feature trade outlook, the prospect for even normal buying during the remainder of this year is not encouraging. Some dealers go so far as to say that trading will continue dull until the spring. The decline in price quotations noted last week is still effective and further shading is probable, in face of the quiet demand.

SOME REDUCTIONS HAVE BEEN MADE

Several Lines are Working Now Toward a Lowered Selling Schedule

TORONTO.—In most lines of the machine tool, iron and steel trade this week business would plead guilty to being very quiet. There are variations from this both ways, some firms claiming that their business is good, going ahead of the same month last year all the way along, while others, on the opposite side, report trading as very quiet and with no large buyers in the market.

It cannot be denied that there are a lot of machine tool quotations out just now, and if they could be converted into real business there would be nothing the matter. The turning of these quotations into real business is not being done rapidly. There can be no doubt that many buyers are anticipating something in the way of an announcement regarding prices or better conditions. Whether this would result in more business being placed at once it is hard to say. Canadian Machinery asked one of the dealers today if such would be the case, and he replied: "That is something I would not undertake to answer. There are some cases where it would not make any difference were I able to go out with a reduction of 30 per cent. On other lines it would make a difference. The standard lines are the ones that are looked to to set the pace in this matter of price reduction. Some of the newer companies sent out notices some weeks ago that they would allow us to deduct as much as 20 per cent. from their April lists, but this did not make any marked difference in sales. There are other cases, though, where it will make a difference. One of the largest makers of boring mills has announced a reduction, and it amounts to quite an item, especially when the quotation in the first place runs around ten to twelve thousand dollars. The reduction is around 15 per cent., and the company, in its report that it is prepared to do this, warns the buying public that they have gone the limit in doing this, and that prices will stand for a long time to come without going any lower."

Questions at other of the machine tool houses brought out the information that no reduction in prices had been authoriz-

ed, although there is a general feeling that something more definite in this can be expected following the meeting of the National Machine Tool Builders' Association at New York.

Discussing the matter of prices with an official of one of the machine tool companies in Canada a few days ago, Canadian Machinery brought up the matter of prices and inquired whether there was any intention on the part of the firm to move toward a lower schedule. The answer was: "Not as long as present costs keep up. The machines we have on hand were made of high cost material, and were we to cut the price without any cut in the price of the material in them we would lose money. I don't see how Canadian makers can cut prices unless there are reductions in materials and wages."

There is a growing feeling in the market that the matter of prices will be dealt with in a definite way shortly. The absence of any announcement does not help matters, and the dealers would be strengthened were something done one way or another.

The prices of high-speed steel tools have been reduced 10 per cent. and on some other lines there have been reductions made in carbons. The list on high-speed drills, for instance, is divided now as follows: ½ inch and under, net, 33-64 to 1 inch, plus 10 per cent.; over 1 inch, plus 20 per cent. The list formerly ran from list plus 10 to plus 30. The new prices came into effect on the 8th of the month, bearing out the intimation in these columns of last week that an adjustment was being made in prices of small tools.

"Will you sell any more at the new prices?"

"That remains to be seen," was the reply of one dealer. "I do not think the price has much to do with it, although the buyer will very often insist that it has. Just now business is small, but there are a fairly large number of the small pieces. We are looking for renewed buying before very long."

Steel Market is Easier

There are few Canadian orders on the books of the premium mills in United States, about the last of this material coming over during the week. Many of those who find it necessary to import are promised consideration very shortly by the Steel Corporation, which is beginning to catch up with some of its bookings. There are certain lines that will still come from the premium mills. For instance, sheets, although Canadian rolled are now available in better supply, will be brought in from the premium mills, but the price is better than prevailing for some time, the chances being that buying can be done now at slightly over 6 cents per pound, a real improvement on the figures that were prevalent some few months ago.

There has been a reduction of $5 per ton in the warehouse price of bar iron in Toronto. This will, of course, also take in bar steel as well. The price is now 5.50 cents per pound, still a mark that stands as very high compared to the usual run of prices for this commodity. Bar iron is coming quite freely from the Canadian mills now, and they are able to look after the great bulk of the business offering, with the exception of the large size rounds and squares.

One Toronto warehouse had a voluntary reduction from one of the premium mills during the last week.

"Were you surprised or insulted?"

"Neither," came the reply. "We are used to anything happening now." Lest there be any doubt, it might be added that the warehouse accepted the reduction.

Delivery of tubes is only fair, prices are firm, and there is a lot of business yet to be attended to.

"Firms are not buying anything that is not absolutely necessary yet," explained one of the dealers to Canadian Machinery to-day. "In no case is a firm taking on stock material. From the 15th of November each year until the end of the holiday season we never look for a great amount of business. It is between seasons, and a few off weeks need occasion no alarm."

POINTS IN WEEK'S MARKETING NOTES

American builders of machine tools are getting better labor results than for months past.

—

Some reductions in machine tool prices are out now, varying from 15 to 20 per cent.

—

National Machine Tool Builders' Association meets in New York on November 11 and 12.

—

U.S. railroads are expected to come into the market with fairly good lists early in the year.

—

Scrap metal prices, with the exception of a few "whites," have been severely pruned. Very little business is offering.

—

Our Pittsburgh correspondent claims that by the first of the year the independent steel mills will not be running over 60 per cent.

—

Pig iron prices have broken quite sharply, and a large tonnage would probably set a new low market figure.

—

High speed small tools are reduced 10 per cent. by Canadian makers. The new list became effective November 1st.

—

Bar iron is selling at 5.50c per pound in Toronto warehouses.

Scrap Prices are Cut

Scrap dealers are out with the axe this week, and they have cut deep into the price schedules that have been standing for some time. Heavy melting, wrought axles, scrap rails, machinery cast iron, car wheels, steel axles and stove plate are the items that escaped notice when the killing was on. Otherwise the list is pretty well battered down. Here is the way in which the largest yard sized up the situation:

"Conditions are, if possible, worse than last week, and there is no guarantee that prices are staple yet. The Steel Co., we hear, is interested in heavy melting steel but at a lowered price, perhaps down three or four dollars from last week. For the first time in a year cast iron shows signs of weakness, and prices are not strong. Steel turnings are also weaker, delivered consuming districts; there is no market for borings and turnings here, although some may be placed across the line. Agricultural and railroad malleable is not in demand at all. Scrap pipe is a drug on the market and cannot be sold. Car wheels and grate bars are in fair demand. Stove plate is weakening, and rerolling rails are a drug now.

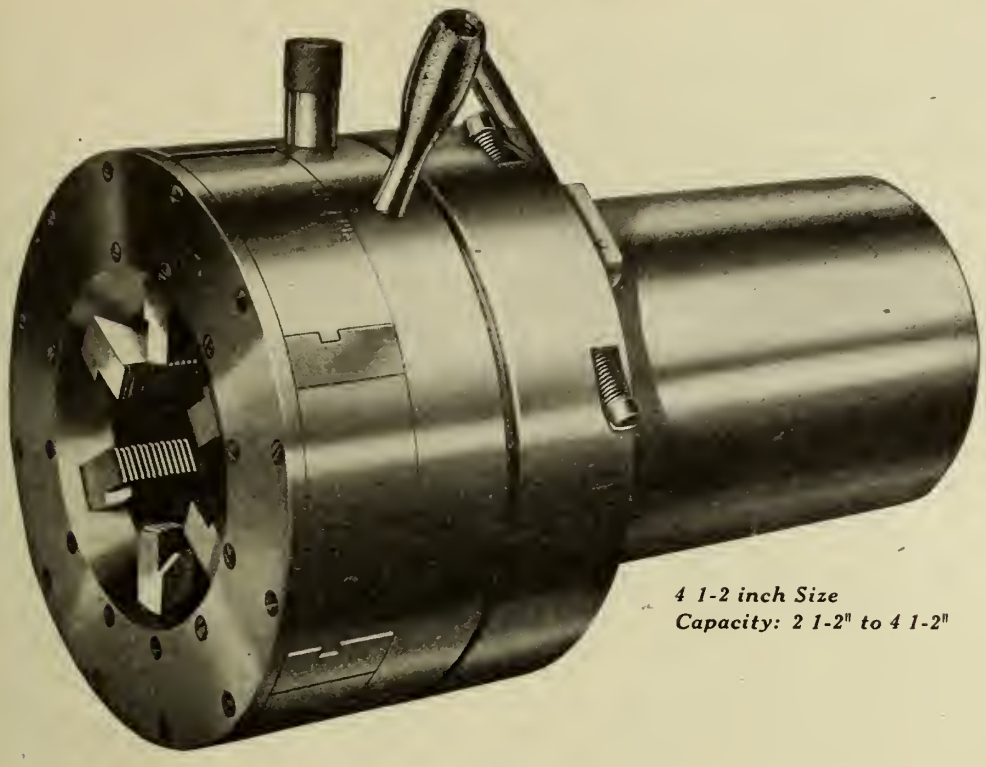
"In the non-ferrous lines heavy copper and wire shows a further decline, and dealers are now offering for No. 1 copper 12 to 12½ cents; light copper is quoted at 10½ cents; No. 1 composition scrap, which is the firmest of all non-ferrous metals, is quoted at 12 cents, the same as No. 1 copper wire. There is no market for heavy yellow brass, and the quotation of 7½ cents is nominal.

"I believe," he said in conclusion, "that there are many dealers in the scrap metal business who are not making their salt at present. Business is poor and there is nothing in which to speculate with a fair chance of profit."

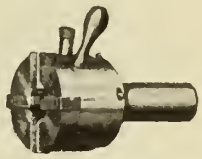
TO GUARANTEE THE COMPANY'S BONDS

Town of Paris to Lend Aid to the MacFarlane Engineering Firm

A proposition has been made to the Paris, Ont., Council by the MacFarlane Engineering Company for the municipality to guarantee bonds for the firm to the amount of $40,000. A committee appointed to investigate made a highly favorable report to a special meeting of the Council as regards the security offered. There were also present some thirty representative members of the Board of Trade, of whom a number spoke in favor of the adoption of the offer. On request of Mayor Patterson, a unanimous vote was passed to support the Council in the movement. A by-law has been prepared and will be submitted to the ratepayers early in December. The firm has already some 75 or 80 men employed, and it is confidently expected that within a few months after the passing of the by-law 200 men will be on the pay roll.



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TOOL MAKERS IN U.S. ARE GETTING BETTER RESULTS FROM WORKMEN

Special to CANADIAN MACHINERY.

NEW YORK, Nov. 11.—One factor which has been somewhat disturbing to business—the presidential election—is now out of the way, and the result is such as to inspire a greater degree of confidence in the early recovery of trade from the depression in which it now finds itself.

However, there are other things to be adjusted before renewed buying on a fairly large scale may be expected. One of the most important is the deflation of prices, which has scarcely touched the machine-tool industry as yet, either as regards costs of manufacture or selling prices.

In a measure, the manufacturers of machine tools have brought about slightly lower labor costs, this being due not so much to reduction in basic wage rates as in greater individual efficiency among workmen. For example, there are many plants which have discharged 10 or 20 per cent. or more of their employees which find themselves getting as much production from the force remaining as they were obtaining with the entire working force. In other words, the men who have jobs are working harder to retain them. This productivity is of even greater importance, from the standpoint of the manufacturer, than any reduction in basic wage rates, which are probably none too high if the men will turn out the work.

There have been a few reductions in selling prices by machine-tool builders, notably one of 15 per cent. put into effect November 1st by a large New England maker of turret machinery. Other reductions are known to be under consideration, but action will be deferred until after the meeting of the National Machine Tool Builders' Association in New York on November 11th and 12th. It is regarded in the trade here as practically certain that many tool manufacturers will go home from this meeting prepared to make substantial cuts in prices, say from 10 to 20 per cent. It is contended, however, that this will be about the limit, as machine tool prices have not been abnormally high.

Immediate business prospects are slightly better in some respects. The Erie Railroad has put out inquiries for six or eight tools, and more inquiries are expected from the same road. One or two other Eastern roads are also on the point of submitting lists to the trade, and this, it is hoped, is the beginning of railroad buying in the East. There has been a fair amount of railroad buying at Chicago in the last few months, but the Eastern roads have done practically nothing since the lines were returned to private ownership. The new freight and passenger rates have been in effect for more than two months and railroad earnings are showing a fair increase; hence it is expected that some of these earnings will soon be expended for rolling stock and shop equipment. In pre-war years it was customary for the railroads to issue their lists of tool requirements about January 1st and do their heaviest buying in February. There is some reason to expect that the same will be true in 1921.

PITTSBURGH NOT QUITE SURE WHERE PRICE LEVELS MAY REST

Special to CANADIAN MACHINERY.

PITTSBURGH, November 11.—There is no material change in the iron and steel situation as to the volume of demand appearing in the open market, the demand being extremely light. The amount of stocks consumers had when the market turned soft cannot be estimated closely. It may have been considerably greater than buyers represented, when they were importuning mills and furnaces for heavier shipments, but whatever the stocks are the buyers wish to reduce them, and they desire to have as small stocks as possible on the inventory date. The quadrennial election last week has had no appreciable effect on the general situation.

The changes that have occurred in the past week have been in connection with prices and the volume of production, both showing more or less declining tendency. The decline in prices is spotty and irregular, affecting some products greatly, others scarcely at all. The decline in production, in the aggregate, is steady, though it is not steady as regards any individual producers.

Pig Iron Production

Since furnaces began blowing out, early in October, about two score stacks in various parts of the country have gone out, the greater part being late in October and early this month, while there were proportionately somewhat more steel works furnaces than merchant furnaces that went out. The blowing out occurring so largely late in October, the month's output was not greatly affected, and with the operating furnaces in receipt of better supplies of coke the month's output as a whole showed an increase over the September rate. In fact the October rate was the best shown for any month this year excepting last March, being about 39,000,000 tons a year, while the rate last March was about 40,000,000 tons. The rate now, however, is doubtless well under 37,000,000 tons.

In the matter of steel production the curtailment depends on the state of order books. As the Steel Corporation is very well filled with business its output has not decreased, and has possibly increased a little. Those of the independents that pursued a relatively conservative course in the matter of prices are moderately well filled, but with cancellations and suspensions are unable to run full, and thus a number have reduced output only by say 10 or 15 per cent. Others, with lean order books, which they cannot replenish to any great extent by cutting prices since there is little business obtainable at any price, have had to curtail more, and probably quite a number of small independents are running at 60 per cent. or less. The necessity for curtailment strikes one mill after another. At the present time many mills are counting up how many weeks their order books will carry them at 50, 60, or 70 per cent. By the end of the year the independents, on an average, will hardly be operating at more than say 60 per cent., and perhaps the average will be under 50 per cent., while even without any improvement in business the Steel Corporation ought to be able to maintain its present rate of output until April or later.

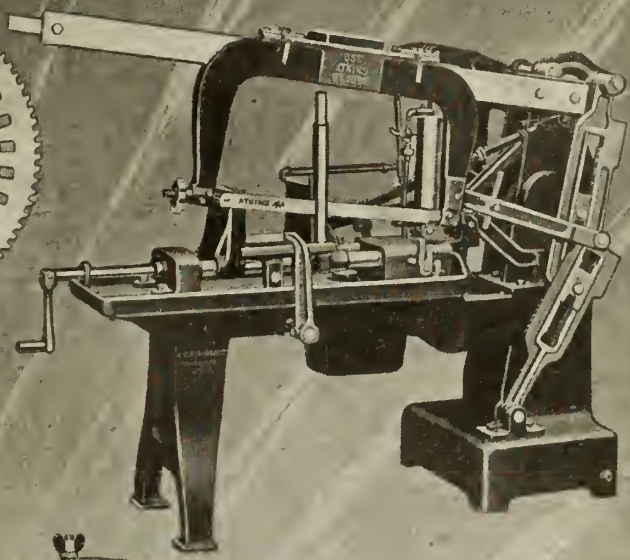
Steel Prices

On bars, shapes and plates the common quotation among independents is now 3 cents. In instances an independent is asking more, but merely as a nominal price to protect contracts on books. On bars there is little, if any shading below 3 cents. On shapes a concession of a dollar or two a ton would probably be obtained without difficulty. In the case of plates there is much irregularity, but it requires an attractive inquiry to bring out a cut price.

In sheets, particularly black sheets, the market seems to be tumbling rather than declining. The market on black sheets had been going down at the rate of say a quarter cent a week until a few days ago 6.25 cents became the common quotation for mills that were really seeking business. There are various reports of prices being done under this figure. It is believed that several mills would quote 6 cents very promptly if they saw chances of booking an order that would put them in a comfortable position for a week or two, say a tonnage running into four figures. It is reported, but not confirmed, that a valley mill sold 2,000 tons at 5.75 cents. Another report is that a mill made a first quarter contract at 5.50 cents, but this is doubted. In one well-informed place the prediction is made that first quarter business with independents will be done, when the time comes, at about a cent per pound above the Steel Corporation price, which has been 4.35 cents, and is likely to remain there, and that when second quarter business is done it will be at about the

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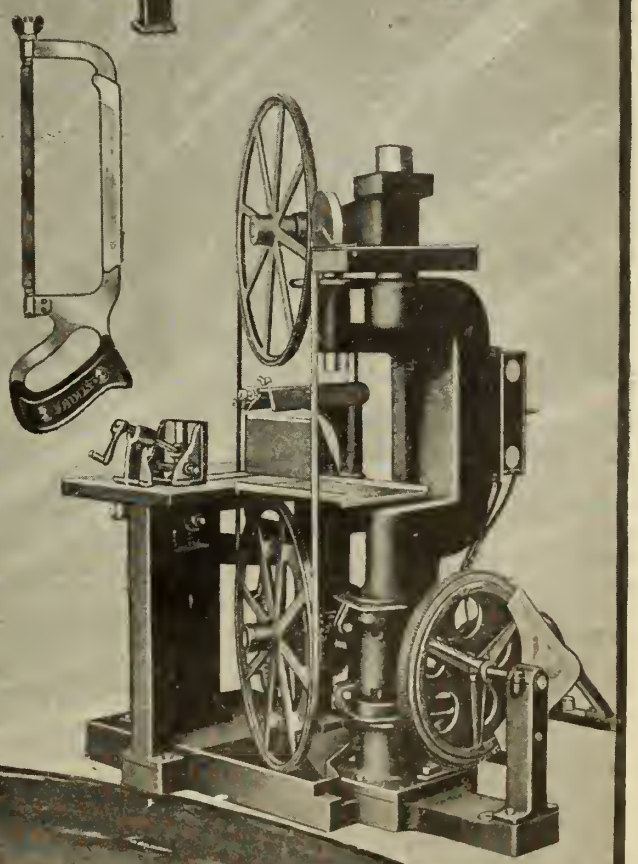
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Steel Corporation level. The corporation will open its order books next month for the first half, but in both sheets and tin plates it will have to carry over about three months of work, so that the new contracts will be in reality for second quarter. This will make no material difference, of course, since the contracts will be with regular customers, who will be getting deliveries in the first quarter on old contracts instead of new contracts.

Pig Iron Breaks

The condition continues in the pig iron market that each inquiry of any size brings out further price declines. The pig iron sellers, who consider themselves salesmen when iron is scarce and they can get higher prices simply for the asking, are now exhibiting the form of salesmanship that consists in quoting a prospective buyer a price and then explaining that the price is largely nominal and they want to hear from the buyer again when he is ready to close. Hitherto the foundry iron market has been considered $45 valley, after the declines from the $50 price reached in August, and forge would naturally be say $1 less. In the past week an inquirer for forge was quoted all the way from $44 to $41, while an inquirer for No. 2 foundry was quoted from $45 down to $41. No purchase was made in either case, the prospective buyers concluding to allow the sellers more time in which to make up their minds positively. On an inquiry for 2,000 tons of basic for the east $38.50 valley was done, or $1.50 below the market as previously established. Bessemer has been offered at $42, or $3 off, finding takers only to the extent of two carloads. An inquiry now pending for 150 tons will bring out a further cut. We quote the market at the moment as follows: Bessemer, $42; basic, $38.50; foundry, $41, f.o.b. valley furnaces, freight to Pittsburgh being $1.96.

Connellsville furnace coke for spot shipment is down $1.50 in the week to $8.50 per net ton at ovens. In the two weeks preceding there has been a decline of $7. Foundry coke is now quotable at $10.50 to $11, though in remote districts, where the buyers have not learned the full size of the slump, $12 has been paid in some instances in the past few days.

No one knows where coke and pig iron will land in the final adjustment, and various predictions are made, and can be defended to an extent, but in quarters where there is the best information and the greatest disposition to form an unbiased opinion, the idea is that furnace coke will land at somewhere in the neighborhood of $7, with foundry coke say a dollar per ton higher, and that pig iron will find its level at not far either way from $30 furnace.

It has been decided to call for tenders for the building of the new Lottridge Street School, Hamilton. The approximate cost is to be $300,000.

MR. IRVING TO TORONTO OFFICE

Change Announced in Selling End of the C.M.C. Business in This District

Mr. W. J. Irving has taken over the management of the Toronto sales branch of the Canada Machinery Corporation. He has been with the C.M.C. ever since there was a C.M.C., and he has covered the ground pretty well from Fort William to Sydney. There may be some metal working shops, and there may be an occasional wood working shop that does not know him at sight, but if so the



W. J. IRVING

plant is probably a very new one, and if they stay in business any length of time W. J. will be on their calling list.

Mr. Irving learned his trade as a pattern maker with John Ballantyne at Hespeler, after which he took up the work of a draftsman, finally spending a good deal of his time as a designer. Several of the lines made by the C.M.C. are Mr. Irving's own ideas.

It was almost ten years ago that he went on the road for the firm, and although he has done several other things, selling machine tools has been his chief business.

One well-known machine-tool salesman, speaking to the writer about Mr. Irving, remarked, "I have been up against him several times, and my complaint about him is that I had to be around too early in the morning and too late in the evening to beat him out. I bet dollars to doughnuts that he has taken orders in the early hours of the morning, and in the late hours of the day. I have known him to sign orders on a stump in the field, and I have seen him getting the necessary signature as the train was pulling in at the station."

For the present at least, Mr. Irving will keep his house at Galt, going there for the week-ends. Mr. Irving, like a good many of the rest of us, believes that there are too many people trying to squeeze into Toronto to live comfortably. However, his activities will be taken up entirely now with his work in connection with the Toronto office.

David King, who has had charge of the Toronto office for many years, is retiring from active work to enjoy a well-earned holiday. Mr. King has passed the three score and ten mark and has had a wealth of experience in the selling end of the machinery business.

J. H. QUIRT DIES IN CALIFORNIA

Was One of the Best Known Machinery Salesmen in This and the Northern Districts

The machine tool trade, and many of the older firms in the machine shop and mill business, will regret to hear of the death of J. H. Quirt in Los Angeles, California. He was born in Ogdensburg, 79 years ago, and at the age of 13 with his parents moved to Arthur, Ont. Later he was apprenticed to the blacksmith trade, working at that for some years. Some time after a partnership was formed by Mr. Quirt with James Shand, now superintendent of the Dodge Co., Toronto. This business took in both the machine shop and molding branches. Following this, Mr. Quirt became connected with the A. R. Williams Machinery Co. and spent nearly all his twenty years with them on the road and attending to collections. Speaking of him this week, Mr. T. A. Hollinrake, president of A. R. Williams, said: "He was one of the best known and best liked men in the machinery business. I doubt if there ever was a man who knew the north country better than he." On account of his health he retired from business about seven years ago, moving, with Mrs. Quirt, to Los Angeles, where he resided until his death. He is survived by his wife, in California, and five daughters: Mrs. James Shand of 96 Uxbridge Street, Toronto; Mrs. Walter Findlay, 143 Cottingham Street, Toronto; Mrs. J. Black, Denver, Colorado; Mrs. F. W. Ritchie, Los Angeles, California, and Mrs. W. D. Young, Covina, California.

An experiment in paving is being carried out on the Victoria Bridge across the St. Lawrence at Montreal, and if the method of paving is successful, the entire length of the bridge will be completed next year. Two hundred feet of mastic flooring are being laid, with the object of determining how well it will withstand the weather during the winter. One advantage claimed for the material is that it is fireproof, and will prevent such disasters as the starting of fires caused by the overheating of gasoline and oil from passing automobiles.



Dumore Grinders in the Delco Tool Room

BUSY, EFFICIENT, ADAPTABLE TOOLS

THE Dumore Grinders at the Dayton Electric Laboratory Company (Dayton, Ohio) are continually busy and the Delco tool makers surely like them. The job you see chucked in the heavy lathe is one of a lot of fine counterbores used in the production of distributor cams on Delco ignition sets. Fine limits are fixed on this job and the Dumore as an internal grinding machine has amply proven its dependability for the accurate grinding of duplicate diameters.

This is only one of the many uses made of Dumore Grinders. For all work where speed and production costs are to be considered—where accuracy is of prime importance—and also for the multitude of odd jobs that arise every day — Dumore Grinders are indispensable

Dynamically balanced, no end play, no vibration. Equipped with S. K. F. and Norma ball bearings. Well built, adaptable, efficient—Dumore Grinders cut costs throughout the shop.

WISCONSIN ELECTRIC COMPANY

2929 Sixteenth Street **RACINE, WISCONSIN**

DUMORE HIGH SPEED GRINDERS

If interested tear out this page and place with letters to be answered.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	48 00
No. 2 Foundry, 1.75 to 2.25%	46 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 75
Steel bars, base, Montreal	5 75
Reinforcing bars, base	5 50
Steel hoops	[illegible]
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	8 50
Chequered floor plate, ¼ in.	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	3 50
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	5 50
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 67 to 5 50
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	58½	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

METALS

	Gross. Montreal	Toronto
Lake copper	$21 00	$22 50
Electric copper	20 50	22 25
Castings, copper	20 00	22 00
Tin	50 00	53 00
Spelter	9 00	10 00
Lead	8 25	9 00
Antimony	8 50	10 00
Aluminum	36 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 35
Plates, ¼ up	6 50	6 60

PIPE—WROUGHT

Standard Buttweld Pipe

Per 100 Ft.

	Steel Blk.	Steel Galv.	Gen. Wrought Iron Blk.	Gen. Wrought Iron Galv.
⅛	$ 6 50	$ 8 50	$.....	$.....
¼	5 31	7 41	5 91	8 01
⅜	5 31	7 41	5 91	8 01
½	7 10	8 63	7 95	9 48
¾	8 80	10 87	9 95	12 02
1	13 01	16 07	14 71	17 77
1¼	17 60	21 74	19 90	24 04
1½	21 04	25 99	23 79	28 74
2	28 31	34 97	32 01	38 67
2½	44 73	55 28	....	....
3	58 52	72 29	....	....
3½	74 06	90 62	....	....
4	87 75	107 37	....	....

Standard Lapweld Pipe

Per 100 Ft.

	Steel Blk.	Steel Galv.	Gen. Wrought Iron Blk.	Gen. Wrought Iron Galv.
2	$32 01	$ 38 67	$35 71	$42 37
2½	48 26	58 79	54 11	64 64
3	63 11	76 88	70 76	84 53
3½	75 90	92 46	85 10	101 66
4	89 93	107 55	100 83	120 45
4½	1 05	1 29	1 30	1 54
5	1 22	1 50	1 52	1 80
6	1 58	1 95	1 97	2 33
7	2 06	2 53	2 53	3 01
8L	2 16	2 66	2 66	3 16
8	2 49	3 07	3 07	3 64
9	2 98	3 67	3 67	4 36
10L	2 77	3 41	3 41	4 05
10	3 56	4 39	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.

4½" and larger, 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%.

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$12 00	$10 50
Copper, crucible	16 00	12 00
Copper, heavy	15 00	12 00
Copper wire	15 00	12 00
No. 1 machine composition	15 00	12 00
New brass cuttings	9 00	9 00
Red Brass turnings	10 50	10 00
Yellow brass turnings	7 00	7 50
Light brass	5 50	5 00
Medium brass	6 50	6 00
Scrap zinc	5 00	5 50
Heavy lead	5 25	5 60
Tea lead	3 50	3 00
Aluminum	17 00	16 00

	Per Ton	Gross
Boiler plate	18 00	12 00
Malleable scrap	23 00	23 00
Axles (wrought iron)	30 00	20 00
Rails (scrap)	20 00	18 00
Malleable scrap	23 00	25 00
No. 1 machine cast iron	34 00	33 00
Pipe, wrought	11 00	10 00
Car wheel	32 00	33 00
Steel axles	23 00	20 00
Mach. shop turnings	9 00	9 00
Stove plate	27 00	25 00
Cast boring	10 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	+10
Carriage bolts, ⅜-in. and less	Net
Coach and lag screws	—15
Stove bolts	55
Wrought washers	—25
Elevator bolts	+10
Machine bolts, 7-16 and over	+10
Machine bolts, ⅜-in. and less	+10
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 50
Nuts, hex., tapped	add 3 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws —20% 25 and	5
Sq. and hex. hd. cap screws	12½
Rd. and fil. hd. cap screws	plus 25
Flat but. hd. cap screws	plus 50
Fin. and semi-fin. nuts up to 1-in.	12½
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	—5
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	+12½
Studs	+5
Taper pins	—12½
Coupling bolts	+40
Planer head bolts, without fillet, list	+45
Planer head bolts, with fillet, list plus 10 and	+55
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	+60
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add +85
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

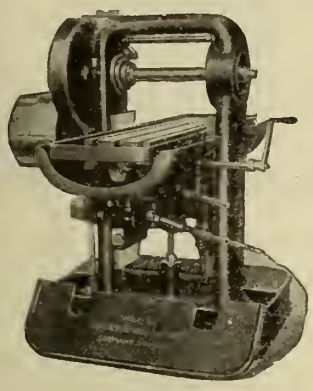
Wire nails, base	$6 10
Cut nails, base	7 00
Miscellaneous wire nails	50%

ROPE AND PACKINGS

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28

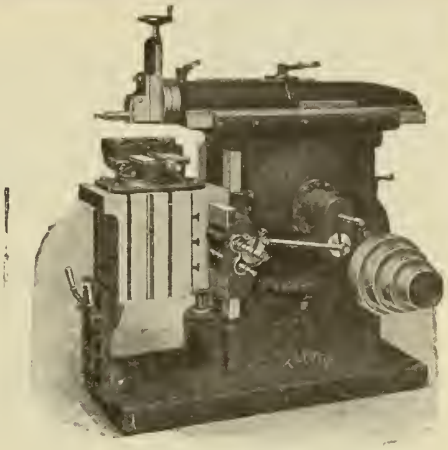
POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net



GARLOCK-WALKER'S

LIST OF METAL WORKING MACHINERY IN DUFFERIN STREET WAREHOUSE, TORONTO



Lathes—Engine

All sizes of Engine Lathes for 7" x 32 to 36" x 18' with D.B.G. or S.B.G., some with taper attachments.

Lathes, Gap

1—C.M.C. 20" x 36" x 12' Q.C.G., D.B.G., taper attachment.
1—South Bend 21" x 30" x 7' D.B.G., taper attachment.
1—Perfect 12" x 17½" x 6' Gap Engine Lathe.

Turret Machines

Milholland, Davis, Oliver make of various sizes and capacities, with full equipment.

Screw Machines

Foster, Prentice, Warner & Swasey and Cleveland, National Acme Automatics.

Drills

3—Woodward & Rogers 4-spindle, ½ in. capacity.
1—Edlund 1B High Speed Sensitive.
1—3-Spindle Silver Gang Drill.
1—20" Rockwell B.G. Power Drill.
1—20" Silver Drill, all geared.
2—20" Champion, all geared Power Drills.
1—36" Bertram B.G. Drill.
1—36" D8 Colburn Drill.

Shapers

1—24" McGregor-Gourlay.
1—16" Rae Shaper.
1—14" McKenzie Shaper.

Grinders

1—Heald No. 60 Internal Grinder.
1—12 x 42 Landis Plain Grinder.
1—8 x 36 Fitchburg Cylindrical.
1—10 x 25 Q.C. Bath Universal.
1—No. 12 Gardner Disc Grinder.
1—Globe Universal Tool and Cutter Grinder
1—Stevens Universal Tool and Cutter Grinder.
1—Lafayette Universal Grinder for lathes.
Emery Grinders, Pedestal, bench type.

Millers

2—Briggs Type B42 Traverse (manufact'g).
1—Briggs Type A22 Traverse (manufact'g).
1—No. 1 Bertram Universal with Dividing Heads.
1—No. 2 Ford-Smith Plain Miller.

Compressors

1—12 x 13 Bury with tank and fittings.
1—10 x 18 Belt Driven Ingersoll-Rand.
1—8 x 8 Sullivan Compressor.

Shears, Punches, &c.

1—Ryerson No. 3 Rotary Bevel Shear, 1 in. capacity.
1—4 in. Stroke Double Arch Press Geared.
Several small Punches and Shears to ½ in. capacity.

Hack Saws

1—Racine No. 10 Power Hack Saw, 8 x 8 capacity.
1—Peerless Power Hack Saw, 6 x 6 capacity.

Furnaces

1—Bellevue Double Chamber Oil Furnace.
1—12 x 15 x 8 Gas Furnace.
1—18 x 11½ x 8 Gas Furnace (West Magott).
1—24 x 18 x 12 Oil Furnace (Gilbert & Barker), with tank blower and pyrometer.

Miscellaneous

1—Morris Portable Crane, 1½-ton capacity, 10 ft. lift.
1—Canton No. 2 Portable 2-ton Crane.
1—Canton No. 2 Portable 1-ton Crane.
Several Hydraulic and Vacuum Pumps.
Several Blowers, Pressure and Exhaust Fans.
Grant Rotary Riveter, capacity 3-16.
Dividing Head for Miller.
Miller Vise.
Several Chucks.
Valve Milling Machines.
Transmission Supplies.

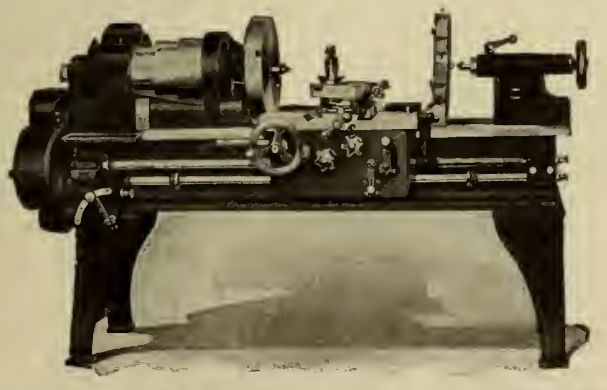
Woodworking Machinery

We have a complete stock of machines for all woodworking operations.

It will be to your advantage to let us have your enquiries

Garlock-Walker Machinery, Limited

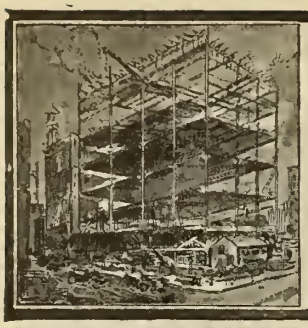
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"Everything in Metal Working and Wood Working Machinery"



If interested tear out this page and place with letters to be answered.



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



TRADE GOSSIP

Selling Plant.—The executors of the estate of the late R. Whitelaw, of Woodstock, are advertising for sale by tender the foundry, machine and boiler manufacturing plant in that city.

Bought New Plant.—Messrs. Langslow, Ltd., Canadian branch of Langslow Fowler, Rochester, N.Y., are equipping a factory in Cobourg for the manufacture of all kinds of school furniture. The Canada Machinery Corporation report having secured the order for all of the wood-working machinery required.

Bought Part of Plant.—Part of the equipment used at the Polson Works, Toronto, has been disposed of, a large amount going to the A. R. Williams Machinery Co. They took in drills, slotter, planer, several large lathes, shaper, drills, gear cutters, etc. The plant is in liquidation and there is still more of it to be disposed of.

Starting New Business. — Holden-Morgan Co., Toronto, are remodelling their plant with a view of specializing on the rebuilding of automobiles. It is their intention to take in cars that have been more or less worn, and rebuild the worn parts, any make of car being taken. Some of the surplus machine tools that were used in the shop previously have been disposed of.

Deal Completed. — The change announced some time ago has been completed whereby the Whitman & Barnes plant, one of the oldest and largest industrial concerns in St. Catharines, has been taken over by J. H. Williams & Co., with plants at Buffalo and Brooklyn. The United States plant will serve the U.S. market, and the St. Catharines plant the Canadian and export trade.

Appointed New Officers.—At a meeting of the directors of the Federal Engineering Co., Ltd., November 3, 1920, Col. F. H. Deacon was elected president of the company. J. W. Campbell, who has been president of the company since its inception, resigned, as he has been living in California for some years. The other officers and directors of the company are: R. G. Black, vice-president; Lieut.-Col. H. L. Edmonds, secretary-treasurer; S. C. DeWitt, manager; A. A. Bowman and J. E. Murphy, directors.

Cutting Production.—Vice-president J. L. Agnew, of the International Nickel Company at Sudbury, announced that the output of the company would be reduced from 4,000 to 3,000 tons of nickel matte per month, bringing production down to the pre-war basis of 1912 and 1913. One furnace will be closed down and the working force is being reduced. About two hundred and fifty men are affected, transient workers being let go first. It is not thought that the regular employees will be hit by the reduction. Business depression in the United States is the cause of the cutting the output by one-fourth.

Still Hope For Coal.—In spite of adverse reports from Government investigators, the Shelburne coal seekers are not discouraged but are keeping right on with the search. A double shift is now at work sinking a shaft on the Lyon farm and as soon as the rock is reached a diamond drill will be put at work. A second diamond drill is being secured, which will be placed on another farm in the prospect area. The promoters are quite sanguine of finding coal in paying quantities; the rest of the Shelburne people have adopted a "wait and see" attitude.

AGAIN URGING HELP FOR BUILDERS

Canadian Vickers Official Brings the Matter Up Following a Launching

The Canadian Commander, 8,350 tons deadweight, the eleventh vessel launched by the Canadian Vickers, Ltd., at Montreal, for the Canadian Government Merchant Marine, was successfully launched and christened by Mrs. C. C. Ballantyne, wife of the Canadian Minister of Marine.

Sir Frederick Orr-Lewis, of the Canadian Vickers, speaking after the launching, urged the desirability of aiding the Canadian shipbuilding industry by means of a subsidy from the government. He pointed out that conditions were far from rosy at the present.

Hon. C. C. Ballantyne, Minister of Marine, said he would bring the matter of a subsidy to the attention of his colleagues in the government. He stated that the Canadian merchant marine now had 40 vessels trading to all parts of the world and would have the full total of 63 in operation next season. The company was run at a profit last year and would be again this year.

PERSONAL

The Owen Sound Board of Trade tendered a complimentary banquet to H. B. Smith, vice-president of the British Empire Steel Corporation, who recently removed from Owen Sound to Toronto. During the evening he was presented with an illuminated address from the Board of Trade and City Council.

G. M. Arnold, for the past ten years Ontario's Government inspector of boilers, died in Toronto, and the funeral was largely attended. Mr. Arnold, who was very widely known and highly esteemed, had been previous to his government appointment for some twenty years with the Niagara Navigation Company.

WILL NOT PAY IF POWER IS CUT OFF

Toronto Firm Says It Is Almost Impossible to Go On Under Present Conditions

Following is copy of a letter sent to the Board of control of Toronto: "It is absolutely impossible to do business on this basis," stated the firm, "and unless some definite arrangement can be made we will have to shut down entirely. Our business is quite slack and we have cut down from 65 to 15 or 20 employees, and while we do not care to be obliged to handle it in this way, we would much rather have our power, say four days a week, and none at all the other three days. We should imagine that other companies would be in the same position. We are today advising our men that from now on we will not pay them for the time for which the power is cut off."

TRY TO BANISH LABOR TROUBLES

Establishment of Joint Councils on the Whitley Plan to Be Advocated

Ottawa.—Steps toward the democratization of Canadian industry are being taken by the Labor Department under an appropriation of $15,000 made for the



Set Screws, Cap Screws
Semi-finished Nuts

MORROW
High Speed Forged Drills



STRONG where strength is needed, proper thickness of web, scientifically built, forged, Morrow Drills give more holes with less regrinding.

Order by the name "Morrow"

JOHN MORROW SCREW & NUT CO., LIMITED

Ingersoll, Canada

MONTREAL	WINNIPEG	VANCOUVER
131 St. Paul St.	Confederation Life	1290 Homer St.

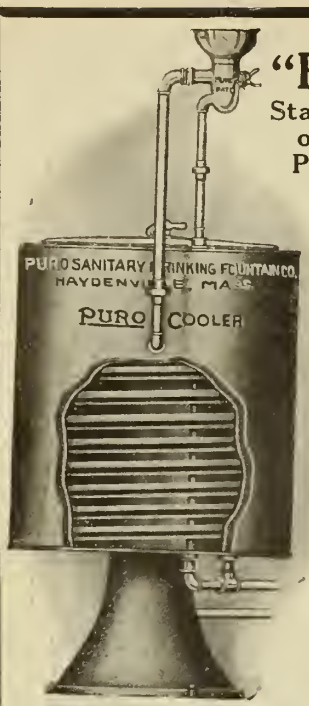
7 Hop Exchange, Southwark St., London, Eng.



We can make your Special Screw Machine Parts for you—send us your Blue Prints or Samples and we will quote you.

If interested tear out this page and place with letters to be answered.

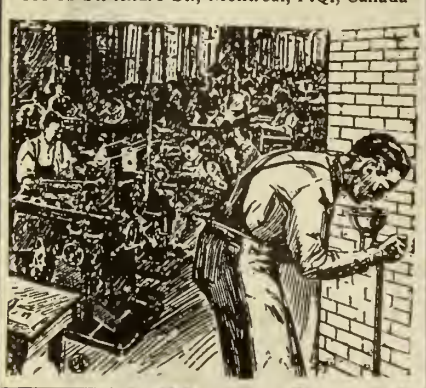
THE "FLU" Stayed out of this PLANT



PURO SANITARY DRINKING FOUNTAIN
(MADE IN CANADA)

The only fountain with a bowl that prevents lips touching the bubbler paid its moderate cost over and over in all those well-ordered plants whose precautionary measures successfully barred the Spanish influenza. PURO saves lives, time and water. Write

Puro Sanitary Drinking Fountain Co.
888 F. St. Andre St., Montreal, P.Q., Canada



BLACK DIAMOND OVENS

OVENS

Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.

Brantford Oven & Rack Co. Ltd.
Brantford, Canada

BLACK DIAMOND OVENS

HIGH CLASS Machine Tools
FOR SHIPYARDS AND CONSTRUCTIONAL WORKS
BERTRAMS LIMITED
SCIENNES EDINBURGH

purpose last session. The purpose of the scheme is to bring about a form of joint control of employers and employed. The method involves the establishment of a joint council connected with various industries on which will be represented both the management and the workmen along the lines of the Whitley councils in England. By this means it is believed a better understanding will be brought about between capital and labor by which differences may be settled and strikes averted. One of the chief functions of the proposed industrial councils will be to arbitrate differences.

FIRMS WANT TO ESTABLISH TRADE RELATIONS WITH CANADA

Information regarding the following lines can be obtained by communicating with this paper and mentioning key numbers.

2263. IRON AND STEEL, HARDWARE ALL KINDS.—A Johannesburg manufacturers' representative, with branch houses in all centres of Union, Rhodesia, British East Africa, Portuguese East Africa, is prepared to consider the representation of Canadian firms prepared for continuity in export.

2264. PLATED WARE.—A Johannesburg firm making a specialty of the hotel trade are prepared to take up the representation of a Canadian house manufacturing plated ware suitable for the hotel trade. The range must not include cutlery.

2265. SHEET METAL GOODS.—A South African commission house, with branch offices throughout the Union, Rhodesia, British East Africa, and South West Africa, requests correspondence from Canadian manufacturers in hollow ware, enamel ware or sheet metal goods of any kind who are prepared for export and are seeking representation.

2266. ENAMEL WARE, TOOLS, WIRE AND HARDWARE OF ALL KINDS.—A Johannesburg agent, covering the Transvaal only, is seeking the representation of Canadian manufacturers in any line suitable for the hardware and building trade.

2267. AGRICULTURAL MACHINERY AND IMPLEMENTS.—A Johannesburg agency firm thoroughly familiar with the agricultural machinery and implement requirements requests correspondence from Canadian manufacturers seeking representation in the South Africa market. All lines interesting, but in a special way their demand is for mowing machinery, hay rakes, ploughs, harrows, (zig-zag and disc), corn planters with fertilizer attachments, hand pumps, cream separators, and in a limited way reapers and binders.

2268. RAILWAY MATERIALS.—A Johannesburg commission house can to advantage handle any range of railway material except machinery. Correspondence is requested from an agency point of view.

2270. A South African commission agent is prepared to consider an agency offer on motor lorries and tractors. Sales agency arrangements only.

2274. HARDWARE.—A firm in Jassy, Roumania, desires to receive quotations and other particulars from Canadian firms in position to export all kinds of hardware.

TRIED TO SEND WORD TO BOSTON

Ontario Section of A. S. M. E. Observed the Fortieth Anniversary of Society's Inception

The fortieth anniversary of the founding of the American Society of Mechanical Engineers was celebrated by the Ontario section of the society at a meeting in the School of Science building, Toronto, on Nov. 5th. Telegrams were received and read from the parent society in New York and from a number of local sections in the United States, and other engineering bodies expressing the cordial feeling between engineers and congratulations on the fortieth birthday. There was also received a cablegram from the Institution of Mechanical Engineers of London, England, reading:

"Heartiest greeting on occasion fortieth anniversary events recent years which demonstrated importance of engineers to civilization and established their power in industrial world indicate necessity for continued expansion of engineering societies' activities, signed Institution of Mechanical Engineers of London."

Prof. James Trail gave an illustrated talk on the Power Canal of the Chippawa development of the Hydro Electric Power Commission. This was specially arranged as advance information for the members, who have been invited by the Commission's engineers to visit the canal. This trip to Niagara will take place within a few weeks and further announcement will be made.

After the lecture, an attempt was made to get in touch by wireless telephone with the Boston Section of the A. S. M. E., who were expected to be sending out messages in connection with their part of the anniversary celebration. The local receiving apparatus under the care of Messrs. Rosebrugh, Duncan and Hill, of the Faculty of Applied Science of the University, was working perfectly and picked up messages from a number of sources but none from Boston. The audience listened through multiple telephone receivers to a concert received over the wireless telephone and were much interested in a description of war time wireless by Mr. Duncan. As the expected Boston message later came by ordinary wire it would appear that the local electrical engineers had done their full duty.

Ottawa.—A temporary setback for the Dominion Government's shipbuilding programme is entailed in the suspension of operations by the Prince Rupert Drydock and Engineering Company, official news of which has been received by the Department of Marine and Fisheries.

At Locomotive Works.—A report from Kingston dealing with labor conditions there says in regard to the Locomotive Works: The Canadian Locomotive Company reports business steady during the past month, with approximately 675 men employed. There is work enough at the present time to keep the men busy until January 1st at least.

Coal Supply Easier.—With the arrival of colder weather officials of the Railway Commission at Ottawa, who are handling fuel control and distribution, are not apprehensive as to supplies, if the early winter weather proves reasonably good. Production in the United States mines has been speeded up to a great extent and the gain in tonnage is being kept up.

Complains of Treatment.—That the Wallace Shipyards at Vancouver had saved the Dominion Government $750,000, but had been refused time for reconsideration when informed that the firm's quotation for the construction of an icebreaker was a few thousands more than the estimate of government engineers, was the statement made by Alfred Wallace to the executive of the Board of Trade, when delivering his inaugural address as its honorary president.



DOMINION CHUCKS

STEEL OR CAST-IRON BODY
BUILT FOR HEAVY DUTY



All Screws Are Reversible

SCREWS are made of the best grade steel. Both ends are broached and are heat treated after machining. They are reversible, so that either end may be used, are large enough in diameter to stand the torsional strains applied by operator when setting up his work. They are made to give the best service—and may be depended upon to stand up under the hardest usage.

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Engineers • Manufacturers
BRANTFORD, CANADA

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Fetherstonhaugh & Co.,
The old established firm. Patents everywhere. Head office, Royal Bank Bldg., Toronto. Ottawa office, 5 Elgin St. Offices throughout Canada.
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DROP FORGE DIES
Send us your blueprints and specifications. Entrust your requirements to experienced workmen and up-to-date equipment. Have your dies made in Canada. First-class workmanship guaranteed.
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Thorold Road, St. Catharines, Ont.

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CLOSING TIME

Advertisements for this section must be in our composing room at noon on Tuesday prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed please try to have them in our office with the Tuesday morning mail.

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2—Large Sturtevant Heating or Ventilating Fans.
2—Small size Sturtevant Mill Exhausters.
8—Root Blowers of various sizes.
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1—20" Aurora Upright Drill Press.
3—15" Engine Lathes, 6 ft. Bed.
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And miscellaneous number of Pulleys from 48" diameter to 6" diameter in Wood Split, Steel Split, Cast Iron, Split and Solid Cast Iron Pulleys.

For prices and further information on above refer to

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At Extremely Low Prices

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Condition equal to new.
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24 x 24 x 5' Pease 1H Planer
16 x 16 x 42" Walter, 1H Planer
14" Steptoe Shaper
16" x 20" x 24" Steptoe, B.G., new Shaper
7" Rhodes, Precision, new Shaper
16" Used Smith-Mills Shaper
16" Used Kelley, B. G. Shaper
No. 4 Brown and Sharpe, Plain Miller
No. 24 Osterlein, Plain Miller
No. 22 Garvin, Vertical Miller
No. 2 M. U. Garvin, Universal, new Miller
No. 1 Dow, Plain, new Miller
No. 3 Burk Hand Miller
No. 3½ Fox Hand Miller
6' Western Universal Radial Drill
3' Mueller, Plain, Radial Drill
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No. 1 Norton Tool and Cutter Grinder.
18 in. x 8 ft. Engine Lathes.
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22 in x 22 in. x 6 ft. Gray Planer.

All in fine condition.

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220/250 Volts

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3½	WESTINGHOUSE		35	GENERAL ELECTRIC	540-1080
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7½	WESTINGHOUSE	850	40	SPRAGUE	800
7½	ALLIS CHALMERS	600	40	GENERAL ELECTRIC	600
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12	AMERICAN ENGINE CO.	1170	50	CROCKER WHEELER	830
15	SPRAGUE	1500	50	IMPERIAL	1000
15	STURTEVANT	800	55	ALLIS CHALMERS	550
15	GENERAL ELECTRIC	1200	60	CROCKER WHEELER	625
15	WESTINGHOUSE	1675	75	WESTINGHOUSE	800
15	CROCKER WHEELER	800	75	WESTINGHOUSE	475
15	GENERAL ELECTRIC	625	80	GENERAL ELECTRIC	750
20	CROCKER WHEELER	775	90	WESTERN ELECTRIC	525
20	GENERAL ELECTRIC	975	100	GENERAL ELECTRIC	720
20	WESTINGHOUSE	975	100	WESTINGHOUSE	700
20	SPRAGUE	1250	120	GENERAL ELECTRIC	450
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25	GENERAL ELECTRIC	560	160	GOODMAN ELEC. CO.	420
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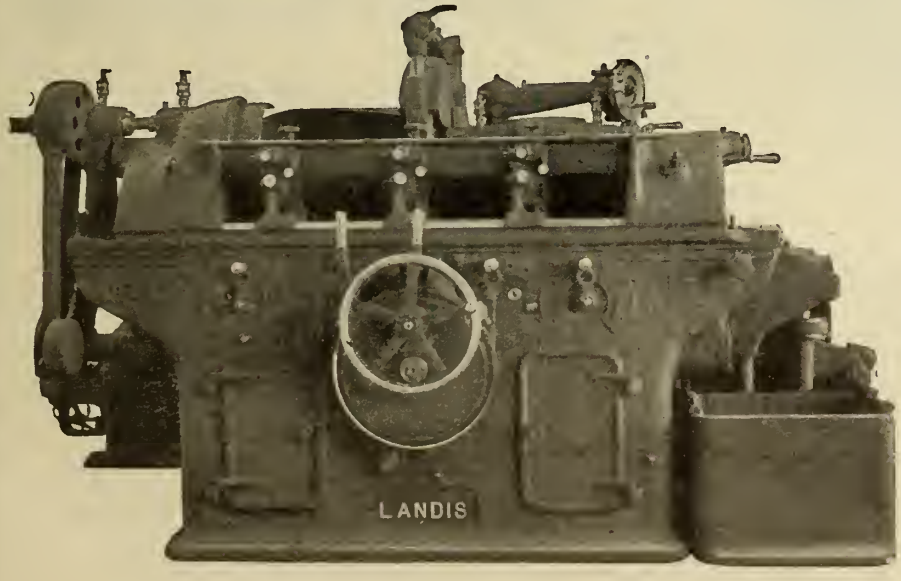
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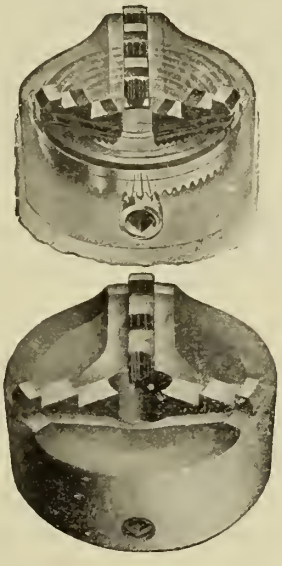
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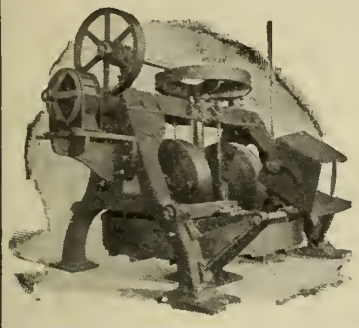


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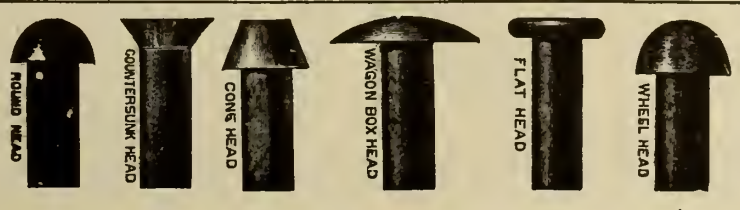
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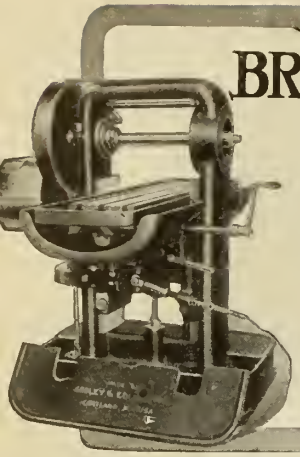
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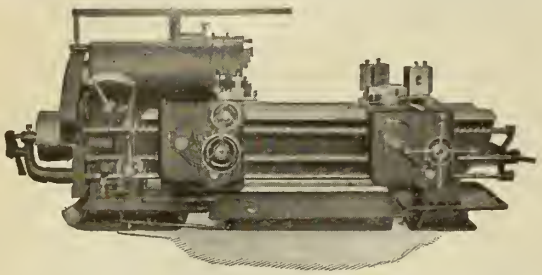
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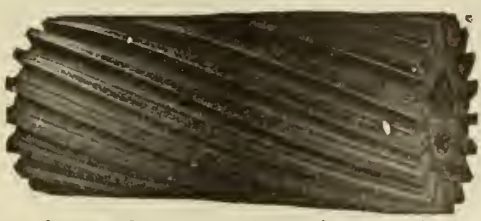
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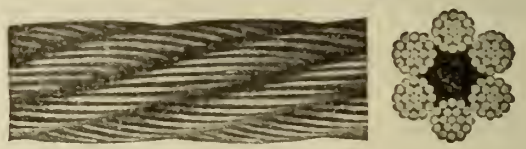


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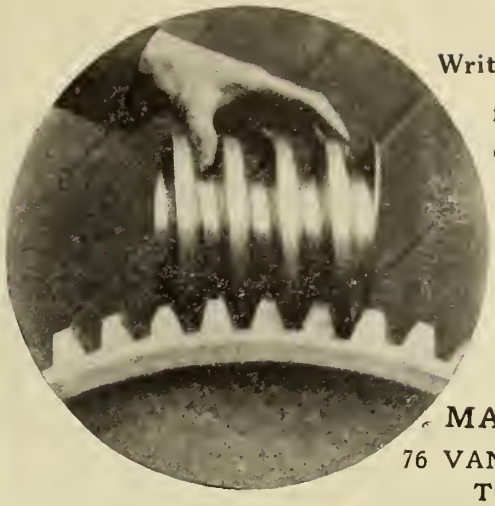
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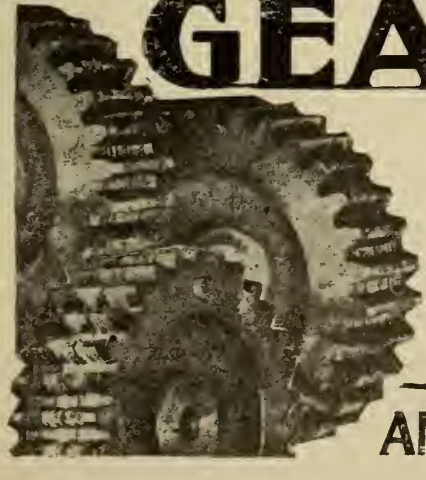
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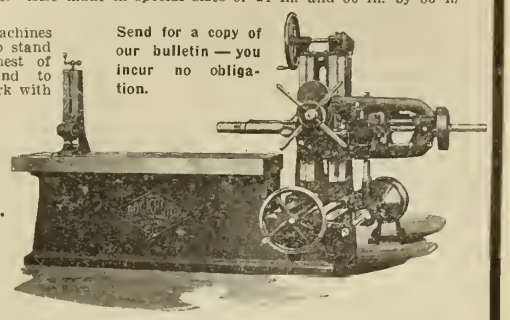
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Prest-O-Lite Co., Inc., Toronto, Ont.
Wood Turret Machine Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.
Brown's Copper and Brass Rolling Mills, New Toronto.

BRICKS, FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

BRIDGES, RLY. AND HIGHWAY
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

BROACHING MACHINES
Strelinger, Chas. A. Co., Windsor, Ont.

BRONZE—SHEETS, ROLLS, PLATES AND RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRONZE, NAVAL
Canada Metal Co., Toronto.

BRONZE COPPER
Tallman Brass and Metal Co., Hamilton.
Canada Metal Co., Toronto.

BRUSHES, CARBON
Lyman Tube & Supply Co., Montreal, Que.

BUFFING AND POLISHING MACHINERY
Ford-Smith Mach. Co., Hamilton.
Foss Mchy. & S'ply Co, Geo. F., Montreal
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BUCKETS, DUMP
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

BUCKETS, ELEVATOR
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

BUCKETS, CLAM SHELL, CRAB, DUMP
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd., Walkerville.

BULLDOZERS
Bertram & Sons Co., John, Dundas.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford
Garlock-Walker Machinery Co., Toronto.
Lourie Mfg. Co., Springfield, Ill.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

BURNERS, OIL AND NATURAL GAS
Northern Crane Works, Ltd., Walkerville.
W. S. Rockwell Co., New York, N.Y.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque.

BUSHING, BRONZE
Morrow Screw & Nut Co., John, Ingersoll

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CABLES, TRANSMISSION AND TELEPHONES
Northern Electric Co., Ltd., Montreal.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Carter Welding Co., Ltd., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Union Carbide Co., of Canada, Limited, Weland, Ont.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville.
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co., Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glasco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

CAR MOVERS
Holden Co., Ltd., Montreal, Que.

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Can. Metal Co., Toronto, Ont.

CASTINGS, DIE CAST
Can. Metal Co., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.
Fisher Motor Co., Ltd., Orilla, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

CASTINGS, STEEL—ALL KINDS
Canada Electric Castings, Ltd., Orilla, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co., Ltd., Orilla, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.

CARRIERS COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll.
Alexander Fleck Ltd., Ottawa.
Tallman Brass & Metal Co., Hamilton

CASTINGS, BENCH LEG
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt, Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown, Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co., Ltd., Orilla, Ont.
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
Interantional Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.
McFarlane Engineering Ltd., G. W., Paris, Ont.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd., Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Morrow Screw & Nut Co., J., Ingersoll.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machinery Co., Toronto.
Lyman Tube & Supply Co., Montreal, Q.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.
Renold of Canada, Ltd., Montreal.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Renold of Canada, Ltd., Montreal.
Williams Mchy Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Can. Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N. Y. Glasgow, N.S.
Renold of Canada, Ltd., Montreal.

CHAINS, SPROCKET WHEEL
Can. Link Belt Co., Ltd., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Ltd., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Labatory, Ltd., Toronto.

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, COLLET, AIR
Petrie, Ltd., H. W., Toronto.
Williams Mchy. Co., A. R., Toronto.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford
Foss Mchy. & Sply Co., Montreal.
Gardner, Robt. & Son, Montreal.
Garlock-Walker Machinery Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Herbert, Ltd., Alfred, Toronto, Ont.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Strelinger, Chas. A. Co., Windsor, Ont.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Warner & Swasey Co., Cleveland, O.
Williams Mchy. Co., A. R., Toronto, Ont.

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Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAY FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

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Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York, N.Y.

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The Dunbar Brothers Co., Bristol, Conn

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.

CLOSETS
Crane, Ltd., Montreal, Que

CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

COAL CRUSHERS
Can. Link-Belt Co., Ltd., Toronto, Ont.

COAL HANDLING MACHINERY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Nova Scotia Steel & Coal Co., New

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Can. Driver-Harris Co., Ltd., Walkerville.
Williams & Co., J. H., Brooklyn, N.Y.

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Can. Blower & Forge Co., Kitchener
Sturtevant Co., B. F., Galt, Ont.

COMPOSITION INGOT
Canada Metal Co., Toronto.

COMPOUNDS, CUTTING AND GRINDING, DRAWING STAMPING
Oakley Chemical Co., New York, N.Y.

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Atkins & Co., E. C., Hamilton, Ont.
Can. Ingersoll-Rand Co., Sherbrooke.
Cleveland Pneumatic Tool Co., Toronto.
Curtis Pneumatic Machy. Co., St. Louis
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Superior Machinery Co., London, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CONDENSERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
MacGovern & Co., Montreal, Que.

CONDUITS
Northern Electric Co., Ltd., Montreal, Que.

CONNECTING RODS
Canada Found's & Forgings, Ltd., Welland, Ont.

CONNECTING ROD CUTTERS INTERCHANGEABLE
Eclipse Counter bore Co., Ltd., Walkerville, Ont.

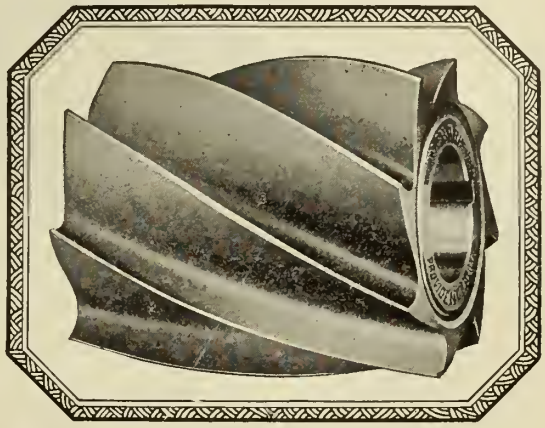
CONTRACT WORK
Brown Engineering Corp., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
Globe Engineering Co., Hamilton, Ont.
Katie Foundry, Ltd., Galt, Ont.
Victoria Foundry Co., Ottawa.

CONTROLLERS, MAGNETIC BRAKES, ELECTRIC WINCHES, MONO RAIL HOISTS
Volta Mfg. Co., Welland, Ont.

CONTROLLERS AND STARTERS
Williams Mach'y. Co., A. R., Toronto.

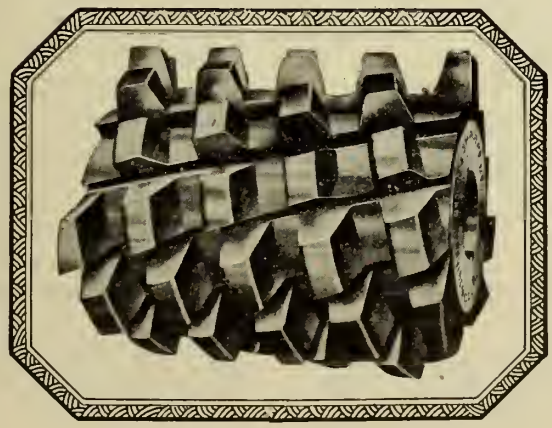
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Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.

COOLERS, WITH DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co. Haydenville, Mass.

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Bertram & Sons Co., John, Dundas, Ont.
Dom. Steel Products Co., Ltd., Brantford
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Can. Blower & Forge Co., Kitchener.

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Brown's Copper and Brass Rolling Mills, New Toronto.

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Swan & Finch, Inc., 165 Broadway.

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Cleveland Twist Drill Co., Cleveland.
Eclipse Counterbore Co., Ltd., Walkerville.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.

COUNTERSINKS, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

COUNTERBORES, INVERTED, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

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Almond Mfg. Co., Ashburnham, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Baird Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
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Williams Mchy Co., Ltd., A. R., Montreal
Williams Mchy Co., A. R., Toronto.

COUPLINGS, FRICTION
Bernard Industrial Co., The A., Fortierville, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto.

COUPLINGS, RAPID HOSE
Ont. Machinery & Supply Co., Ltd., Montreal, Que.

COILING MACHINERY, WIRE AND SPRING
Garlock-Walker Machinery Co., Toronto.

BUCKET
Hanna & Co., M. A., Cleveland, O.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Cleveland Pneumatic Tool Co. of Canada, Toronto.

CRANES, OVERHEAD, HAND AND
Gardner, Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Northern Crane Works, Walkerville.

ELECTRIC
Volta Manufacturing Co., Welland, Ont.

CUPS, OIL
Can. Winkley Co., Ltd., Windaor, Ont.

COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.

CRANES, GRAVITY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

CRANE RUNWAYS
MacKinnon Steel Co., Sherbrooke, Que.

CRANES, JIB
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, LOCOMOTIVE
Brown Hoisting Machinery Co., Cleveland, Ohio.
Holden Co., Ltd., Montreal, Que.

CRANES, GOLLIATH, PNEUMATIC AND PORTABLE
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane and Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Petrie, Ltd., H. W., Toronto.

CRANES, PILLAR
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy. Co., A. R. Toronto, Ont.

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Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Oliver Engineering Co., Montreal.

CRANK SHAFTS
Can. Found's & Forgings Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.

CRANK PIN TURNING MACHINE
Herbert, Ltd., Alfred, Toronto, Ont.

CRIMPS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass.

CRUSHERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.

CUPOLAS
Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.

CURB PUMPS FOR OIL, GASOLINE
Bowser Co., Ltd., S. F., Toronto, Ont.

CURRENT TRANSFORMERS
Volta Manufacturing Co., Welland Ont.

CUT-OFF COUPLINGS, FRICTION
Petrie, Ltd., H. W., Toronto.

CUTTERS, BOLT
See Bolt Cutters

CUTTERS, GEARS
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto

CUTTER HEADS
Oliver Machinery Co., Grand Rapids, Mich.

CUTTERS, PIPE (See Pipe Cutters)

CUTTERS, HIGH SPEED
Madison Mfg. Co., Madison, Wis.

CUTTERS, MILLING
Butterfield & Co., Rock Island, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Sply. Co., G. F., Montreal.
Garvin Machine Co., New York.
Ingersoll Mache. Co., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg. Co., Hartford, Conn.
Wilt Twist Drill Co., Walkerville, Ont.

CUTTER RELIEVING MACHINES
Cleveland Milling Machine Co., Cleveland

CUTTING-OFF MACHINES
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Bertram & Sons Co., John, Dundas.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
G. F. Foss Mchy. & Sply. Co., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass.
Kennedy & Sons, Wm., Owen Sound
Lyman Tube & Supply Co., Montreal, Que.
Niles-Bement-Pond Co., New York.
Prest-O-Lite Co., Inc., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Williams Tool Corp. of Canada, Ltd., Brantford, Ont.
Wells Bros., of Can., Galt, Ont.
Williams Mchy. Co., A. R., Toronto, Ont.

CUTTING COMPOUND AND CUTTING OIL
Cataract Refining Co., Ltd., Toronto
Swan & Finch, Inc., New York.

CUTTING OIL, RECLAIMING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

CUTTING AND WELDING PLANTS
Davis-Bournonville Co., Jersey City, N.J.
Prest-O-Lite Co., Inc., Toronto, Ont.

CYANIDE AND LEAD BATH POTS
Swedish Crucible Steel Co., Windsor.

CYLINDERS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton, Ont.

REHUMIDIFYING
B. F. Sturtevant Co., Galt, Ont.

DERRICKS
Aikenhead Hardware Co., Toronto, Ont.
Dominion Bridge Co., Montreal.
Hepburn Co., Ltd., J. T., Toronto, Ont.
Morris Crane & Hoist Co., Sherbrook.

DIAMOND (BORTZ)
Furniss, Clarke & Co., Montreal, Que.

DIAMOND TOOLS
Can. Desmond-Stephan Mfg. Co., Hamilton.
Ford-Smith Machine Co., Hamilton, Ont.
Furniss Clark & Co., Montreal, Que.
Joyce-Koebel Co., Inc., New York City
Wheel Trueing Tool Co., Detroit.
Petrie Ltd., H. W., Toronto.

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Joyce Koebel Co., Inc., New York, N.Y.
Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.

DIE CASTINGS
Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

DIE HEADS, AUTOMATIC
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

DIES FOR BIT BRACE USE
Butterfield & Co., Rock Island, Que.
Crescent Mche. Co., Ltd., Montreal, P.Q.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Wells Brothers Co., of Canada, Galt.

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Aikenhead Hardware Co., Toronto, Ont
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Brown, Boggs Co., Hamilton, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
Herbert Ltd., Alfred, Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Jones & Lamson, Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
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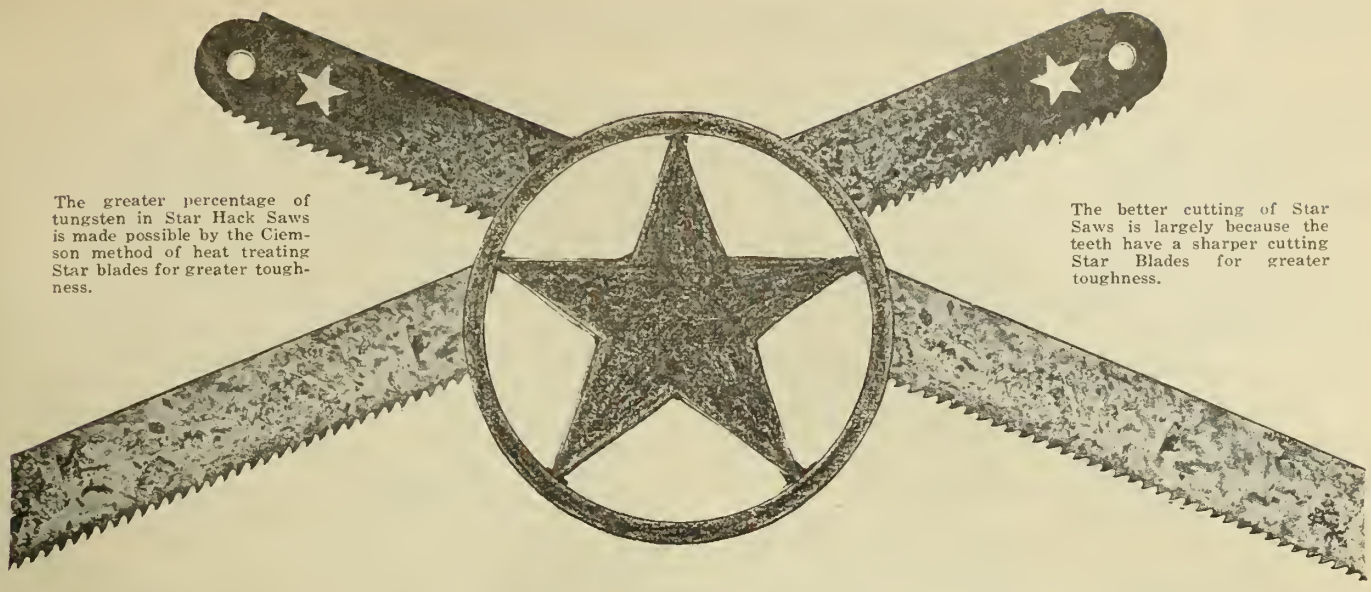
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IN many of the largest plants, it is the general practice to requisition for hack saw blades with this specification:

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The elements that made Star Blades superior are found in their entirety only in Star Blades. There is no such thing as "Star Blades **or equal.**"

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General Combustion Co., Ltd., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

KNIVES, MACHINE
Atkins & Co., E. C., Hamilton, Ont.

LABORATORIES, INSPECTION AND TESTING (see Chemists)

LADLES, FOUNDRY
Northern Crane Works, Walkerville.

LACING MACHINES
Clipper Belt Lacer Co., Grand Rapids, M.

LAG SCREW GIMLET POINTERS
National Machy. Co., Tiffin, Ohio.

LATH
Robertson, Ltd., H. H., Sarnia, Ont.

LATHES, CHUCKING
Acme Machine Tool Co., Cincinnati, Ohio.
Petrie, Ltd., H. W., Toronto.

LATHE CHUCKS (See Chucks)

LATHE DOGS AND ATTACHMENTS
Armstrong Bros. Tool Co., Chicago.
Hendey Machine Co., Torrington, Conn.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

LATHES, AUTOMATIC AND SEMI AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Herbert, Ltd., Alfred, Toronto, Ont.

LATHES, AXLE
Betts Mach. Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, BORING
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.

LATHES, PRECISION, BENCH
J. G. Blount & Co., Everett, Mass.
Canadian Fairbanks-Morse Co., Montreal
Gen. F. Foss Machy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Seneca Falls Mfg Co., Seneca Falls, N.Y.
Strelinger Co., C. A., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, BRASS
Ackworthie Ltd., J., Birmingham, Eng.
Acme Machine Tool Co., Cincinnati, Ohio.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, ENGINE
Acme Machine Tool Co., Cincinnati, O.
John Bertram & Sons, Co., Dundas.
Canada Machy. Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal.
G. F. Foss, Mchy. & S'ply Co., Montreal
Garlock-Walker Machinery Co. Toronto.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
Lehman Mach. Co., St. Louis, Mo.
R. McDougall Co., Galt.
Niles-Bement-Pond Co., New York.
Perfect Machine Co., Galt, Ont.
Standard Equipment & Tool Wks. Montreal, P.Q.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Sidney Tool Co., Sidney, Ohio.
Strelinger Co., C. A., Windsor, Ont.
Walcott Lathe Co., Jackson, Mich.
A. R. Williams Machy. Co., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, FOOT POWER
Seneca Falls Mfg. Co., Seneca Falls, N.Y

LATHES, HORIZONTAL
Intern'l. Mchy. Supplies Ltd., Montreal.

LATHES, JOURNAL TRUEING
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, PATTERNMAKERS'
J. G. Blount Co., Everett, Mass.
Can. Machinery Corp., Galt.
G. F. Foss Mchy. & S'ply Co., Montreal
Garlock-Walker Machy. Co., Toronto, Ont

LATHES, POLISHING
Ackworthie Ltd., J., Birmingham, Eng.
Greenfield Tap & Die Corp., Greenfield
Wells Bros. of Canada, Galt, Ont.

LATHES, SCREW CUTTING
Bertram & Sons Co., John, Dundas, Ont.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & Sply Co., G. F., Montreal
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Lehman Machine Co., St. Louis, Mo.
Niles-Bement-Pond Co, New York.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Strelinger Co., C. A., Windsor, Ont.
Williams Machy. Co., A. R., Toronto.

LATHES, SPINNING
Bliss Co., E. W., Brooklyn, N.Y.

LATHES, TOOL ROOM
Canada Machinery Corporation, Galt, Ont.
Lehman Machine Co., St. Louis, Mo.
Seneca Falls Mfg. Co., Seneca Falls, N.Y
Strelinger, Chas. A. Co., Windsor, Ont.

LATHES, QUICK CHANGE
Lehman Machine Co., St. Louis, Mo.

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Atkins & Co., E. C., Hamilton, Ont.

LATHES, TURRET
Acme Machine Tool Co., Cincinnati, Ohio
Herbert Ltd., Alfred, Toronto, Ont.

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British Smelting & Refining Co., Ltd. Montreal, Que.
Hoyt Metal Co., Toronto, Ont.

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Turner Brass Works, Sycamore, Ill.

LEATHER STRAPPING
Graton & Knight Mfg. Co., Worcester, M

LENSES FOR GOGGLES
Standard Optical Co., Geneva, N.Y.

LEVELS
Hughes, Owens Co., Ltd., Montreal, Que

LIDS, SCREW TOP AND HINGE
Can. Winkley Co., Ltd., Windsor, Ont.

LINK BELTING
See Belting, Chain.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland

LOCKERS, STEEL WARDROBE AND STEEL MATERIAL
Canada Wire & Iron Gds. Co., Hamilton
Dennis Wire & Iron Works, London, Ont

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Cataract Refining & Mfg. Co. Toronto
Swan & Finch, Inc., New York

LUBRICANTS, CUTTING AND GRINDING, DRAWING, STAMPING
Oakley Chemical Co., New York N.Y.

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Bowser Co., Ltd., S. F., Toronto, Ont.

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Thos. Pink Co., Ltd., Pembroke, Ont

MACHINE COUNTER WEIGHTS
Katie Foundry, Galt, Ont.

MACHINE TOOLS
Barber Mach. Co., F. F., Toronto, Ont

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Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machy. Co., Toronto, Ont
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Machy. Co., A. R., Toronto.

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Crescent Machine Co., Ltd., Montreal
Globe Engineering Wks., Hamilton, Ont

MACHINERY, SPECIAL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Que.
McClean Machine & Tool Co., Ltd., Hamilton, Ont.

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Brown & Sharpe Mfg. Co., Providence, R.I
Starrett Co., L. S., Athol, Mass.

MAGNETIC BRAKES FOR ELECTRIC MOTORS
Volta Mfg. Co., Welland, Ont.

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Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.

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Brown, Boggs Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Perrin, Wm. R., Toronto.
Petrie, Ltd., H. W., Toronto.

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Quaker City Rubber Co., Philadelphia Pa
International Mchy. Sply., Ltd., Montreal

MEASURING MACHINES
Pratt & Whitney Co. Dundas, Ont.

MEASURES, REGISTERING
Bowser Co., Ltd., S. F., Toronto, Ont
MEASURING TAPES AND RULES
Chesterman & Co., Jas., Sheffield, Eng

MERCHANTS, IRON AND STEEL
Samuel Osborne (Can.), Ltd., Montreal

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See Chemists.

METAL CLEANERS
Oakley Chemical Co., New York, N.Y.

METAL CUTTING MACHINES
Atkins & Co., E. C., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.

METAL SAWS
See Saws.

METAL SAWS, POWER
E. C. Atkins & Co., Inc., Indianapolis
Hoefer Mfg. Co., Freeport, Ill.
Lyman Tube & Supply Co., Montreal, Que.

METALS
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.
Canada Metal Co., Toronto, Ont.
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
Hoyt Metal Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal

METAL, STAMPINGS, SMALL
Can. Winkley Co., Ltd., Windsor, Ont

METERS, OIL, GASOLINE, KEROSENE, ETC.
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General Combustion Co., Ltd., Montreal Que.

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Taylor, J. A. M., 518 Stair Bldg., Toronto
Petrie, Ltd., H. W., Toronto.

MILLS, BRACE AND TUBE
Elec. Steel & Metals, Welland, Ont

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Atkins & Co., E. C., Hamilton, Ont.

MILLS, SAND
Frost Mfg. Co., Chicago, Ill.

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Alexander Fleck, Ltd., Ottawa.
Greenfield Tap & Die Corp., Greenfield
Wells Bros. of Canada, Galt, Ont

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Ackworthie Ltd., J., Birmingham, Eng.
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Strelinger, Chas. A. Co., Windsor, Ont.

MILLING ATTACHMENTS
Ackworthie Ltd., J., Birmingham, Eng.
Bertram & Sons Co., John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Hendey Mach. Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Keuffel & Esser Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.

MILLING MACHINES, AUTOMATIC
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Betts Machine Co., Rochester, N.Y.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.

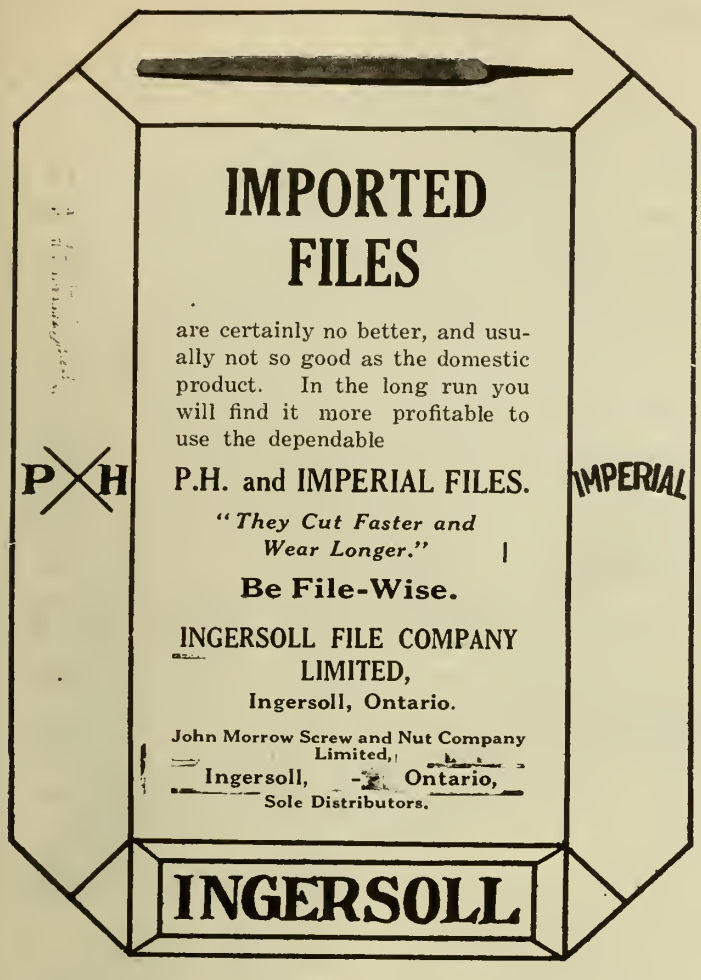
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Cleveland Milling Machine Co., Cleveland.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Herbert, Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

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Bristol Machine Tool Co., Bristol, Conn.

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Gisholt Machine Co., Madison, Wis.
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Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.
Strelinger, Chas. A. Co., Windsor, Ont.

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Bristol Machine Tool Co., Bristol, Conn.
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Bertram & Sons Co., John, Dundas, Ont
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Cochrane-Bly Co., Rochester, N.Y., U.S.A
Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Herbert, Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rockford Milling Mach. Co., Rockford, Ill
Strelinger, Chas. A. Co., Windsor, Ont.
United States Mach. Tool Co., Cincinnati.
Williams Machy. Co., A. R., Toronto

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Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence
Canada Machinery Corp., Galt, Ont.
Cleveland Milling Machine Co., Cleveland.
Cincinnati Milling Machine Co., Cincinnati
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National Machy. Co., Tiffin, Ohio.
Gooley & Edlund, Inc., Cortland, N.Y.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.
Strelinger, Chas. A. Co., Windsor, Ont.

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Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
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MacKinnon Steel Co., Sherbrooke, Que.
Pratt & Whitney Co., Dundas, Ont.

MINING MACHINERY

Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.
Holden Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MIXERS, SAND

Frost Mfg. Co., Chicago, Ill.

MORTISING CHAINS

Renold of Canada Ltd., Montreal.

MORTISING MACHINES

Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.

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Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Toronto.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Sturtevant Co., B. F., Galt, Ont.
Volta Mfg. Co., Welland, Ont.
Williams Mach'y Co. A. R., Toronto.

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MOTORCYCLE FRAME AND FORK

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Cleveland Pneumatic Tool Co., Toronto.
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MOULDS, RUBBER

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

MULTIPLE INDEX CENTRES

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Graton & Knight Mfg. Co., Worcester, M.

MULTI-DRILLING, MULTI-BORING, MULTI-TAPPING MACHINERY,

Nat. Automatic Tool Co., Richmond, Ind.

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Morrow Screw & Nut Co., J., Ingersoll, Ont.

NAME PLATES, BRONZE, ETCHED AND STAMPED

Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS

Can. Driver-Harris Co., Ltd., Walkerville.

NICKEL

Pilot Steel & Tool Co., Montreal, Que.

NICKEL STEEL

See Steel.

NICKEL SILVER—SHEETS, ROLLS, PLATES and RODS

Brown's Copper and Brass Rolling Mills, New Toronto.

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Landis Machine Co., Waynesboro, Pa.
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NITROGEN

Carter Welding Co., Toronto, Ont.

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Galt Machine Screw Co., Ltd., Galt, Ont.
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National-Acme Co., Cleveland, Ohio.
Wilkinson & Kompass, Hamilton.

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National Machy. Co., Tiffin, Ohio.

NUT FACING AND BOLT SHAVING MACHINES

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National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Victor Tool Co., Waynesboro, Pa.

NUT TAPPERS

Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

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All-Way Oiler Mfg. Co., Toronto, Ont.

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Can. Fairbanks-Morse Co., Montreal.

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Aikenhead Hardware Co., Toronto, Ont.
Carborundum Co., Niagara Falls, N.Y.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Norton Co., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

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OIL STORAGE SYSTEMS

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Brantford Oven & Rack Co., Brantford
MacKinnon Steel Co., Sherbrooke, Que.

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Holden Co., Ltd., Montreal, Que.
L'Air Liquide Society, Toronto, Ont.
Prest-o-Lite Co., Inc. Toronto, Ont.
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OXYGEN

Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.
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International Mach. Spls., Ltd., Montreal
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co., Philadelphia, Pa

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Can. Link-Belt Co., Toronto, Ont.
Gutta Percha & Rubber, Ltd., Toronto.
MacKinnon Steel Co., Sherbrooke, Que.

PARTITIONS, WIRE

See Guards

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Garlock-Walker Machinery Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

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Garlock-Walker Machinery Co., Toronto
Oliver Machy. Co., Grand Rapids, Mich
Petrie, Ltd. H. W., Toronto
Strelinger, Chas. A. Co., Windsor, Ont.

PATTERN MAKERS' LATHES

See Lathes.

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Marion & Marion, Montreal.
Ridout & Maybee, Toronto.

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Can. Link-Belt Co., Toronto, Ont.

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British Smelting & Refining Co. Ltd., Montreal, Que.

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Steel Co. of Canada, Ltd., Hamilton, Ont.

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Morrow Screw & Nut Co., J., Ingersoll, Ont

PINS, BELT-LACING

Clipper Belt Lacer Co., Grand Rapids.

PIPE, BLACK & GALVANIZED

Crane, Ltd., Montreal, Que.

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International Malleable Iron Co., Guelph.

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Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
McDougall Co., R., Galt.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

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William Hamilton Co., Peterboro, Ont.

PIERCING

Oliver Machy. Co., Grand Rapids, Mich.

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Greenfield Tap & Die Corp., Greenfield.
Wells Bros. Co. of Canada, Galt, Ont
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

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Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE CUTTERS AND REAMERS

Greenfield Tap & Die Corp., Greenfield.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. of Canada, Galt, Ont.

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Greenfield Tap & Die Corp., Greenfield.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. of Canada, Galt, Ont.

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Ackworthie Ltd., J., Birmingham, Eng.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE WRENCHES

Greenfield Tap & Die Corp., Greenfield
Wells Bros. of Canada, Galt, Ont.

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National Acme Co., Windsor, Vt.

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Morrow Screw & Nut Co., J., Ingersoll, Ont

PLANER JACKS

Armstrong Bros. Tool Co., Chicago.

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Oliver Machy. Co., Grand Rapids, Mich
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
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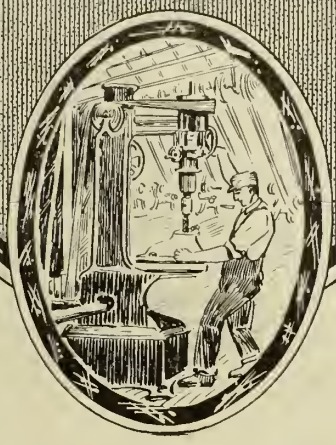
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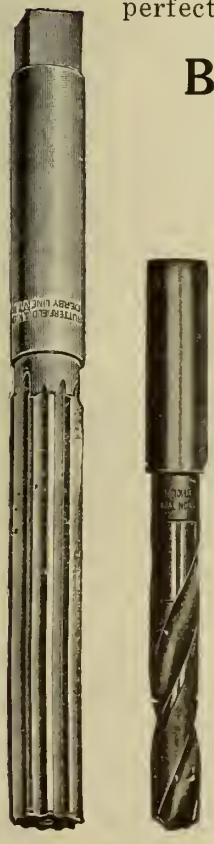
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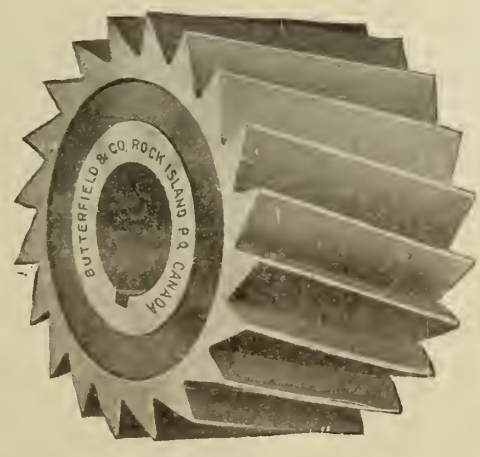
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John Morrow Screw & Nut Co., Ingersoll.
National Acme Co., Montreal.
Rice Lewis & Son, Toronto.
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Wilkinson & Kompass, Hamilton.

SCREW COLLARS
Galt Machine Screw Co., Ltd., Galt, Ont.
John Morrow Screw & Nut Co., Ingersoll.

SCREW MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence, R.I.
Herbert, Ltd., Alfred, Toronto, Ont.

SCREW PLATES
Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto.
J. A. M. Taylor, Stair Bldg., Toronto.
Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton.

SCREWS, SAFETY SET
Galt Machine Screw Co., Ltd., Galt, Ont.

SCREW SLOTTERS
Butterfield & Co., Inc., Rock Island, Que.
Garvin Machine Co., New York.
National Acme Co., Cleveland, O.
Pratt & Whitney Co., Dundas, Ont.

SELF-OPENING DIES
See Dies.

SET SCREWS, SAFETY
Aikenhead Hardware Co., Toronto.
Bristol Co., Waterbury, Conn.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wilkinson & Kompass, Hamilton.

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Jacobs Mfg. Co., Hartford, Conn.

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Robt. Gardner & Son, Montreal.
Garlock-Walker Mach'y. Co., Toronto.
Herbert, Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
Standard Equipment & Tool Wks., Montreal.
Walcott Lathe Co., Jackson, Mich.
Williams Mchy Co., A. R., Toronto, Ont.

SHAPERS, GEAR
Fellows Gear & Shaper Co., Springfield, V.

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Can. Fairbanks-Morse Co., Montreal.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
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Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

SHARPENING STONES
Norton Co. of Canada, Ltd., Hamilton, Ont.
Norton Co, Worcester, Mass.
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Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
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Garlock-Walker Machy. Co., Ltd., Toronto
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Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

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Brown, Boggs Co, Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Strelinger, Chas. A. Co., Windsor, Ont.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co., A. R., Toronto, Ont.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio.

SHEARS, PLATE CUTTING, SLITTING
Dom. Steel Products Co., Ltd., Brantford.

SHEARS, SPLITTING
Dom. Steel Products Co., Ltd., Brantford.

SHEARS, IRREGULAR AND CIRCLE CUTTING
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SHEARS, SQUARING
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D. H. Stoll Co., Inc., Buffalo, N.Y.

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D. H. Stoll Co., Inc., Buffalo, N.Y.

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Brown, Boggs & Co., Hamilton.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Inc., Buffalo, N.Y.
Strelinger, Chas. A. Co., Windsor, Ont.

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SHEETS, BLACK AUTO AND GALVANIZED
Peckovers, Ltd., Toronto, Ont.

SHEETS, NICKEL, RESIST, ALLOY
Can. Driver-Harris Co., Ltd., Walkerville.

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Dennis Wire & Iron Works, London.

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Dennis Wire & Iron Works, London.

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J. H. Williams & Co., Brooklyn, N.Y.

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Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
Renold of Canada Ltd., Montreal.

SLEDGES
Aikenhead Hardware Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont

SLINGS, CHAINS
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

SLOTTERS
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Herbert, Ltd., Alfred, Toronto, Ont.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.

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William Hamilton Co., Peterboro, Ont.
MacKinnon Steel Co., Sherbrooke, Que

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J. Morrow Screw & Nut Co., Ingersoll, Ont

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Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Que
Cleveland Twist Drill Co., Cleveland
J. Morrow Screw & Nut Co., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

SOIL PIPE FITTINGS, CAST IRON
Katie Foundry, Galt, Ont.

SOLDERING IRONS
Aikenhead Hardware Co., Toronto, Ont.
Brown, Boggs & Co., Hamilton, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

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British Smelting & Refining Co., Ltd. Montreal, Que.
Aikenhead Hardware Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Hoyt Metal Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.

SPELTER
British Smelting & Refining Co., Ltd., Montreal, Que.

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Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

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Barnes, Wallace Co., Bristol, Conn.
Can. Steel Foundries, Ltd., Montreal.
Cleveland Wire Spring Co., Cleveland.
Dumbar Bros. Co., Bristol, Conn.
Garlock-Walker Machinery Co., Toronto

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Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Brown Engineering Corp., Toronto, Ont
Dom. Steel Products Co., Ltd., Brantford
Ford-Smith Machine Co., Hamilton, Ont
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
Globe Engineering Co., Ltd., Hamilton.
Hamilton Co., Ltd., Wm., Peterborough
A. B. Jardine & Co., Hespeler, Ont.
Katie Foundry, Galt, Ont.
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
National-Acme Co., Cleveland, Ohio.
Mesta Machine Co., Pittsburgh, Pa.
Stoll Co., D. H., Buffalo, N.Y.
Victoria Foundry Co., Ottawa, Ont.
William R. Perrin, Ltd., Toronto.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

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McClean Machine & Tool Co., Ltd., Hamilton, Ont.

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Eclipse Counterbore Co., Ltd., Walkerville, Ont.

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Garvin Machine Co., New York.

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SPRINGS STEEL
Barnes Co., Wallace, Bristol, Conn.

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Morse Chain Co., Ithaca, New York.

SPROCKETS, SPRING
Morse Chain Co., Ithaca, New York.

SPROCKETS, CHAIN
Can Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia
Renold of Canada Ltd., Montreal.

SPRINGS FOR TOYS AND ELECTRIC DEVICES
The Dunbar Bros. Co., Bristol, Conn.

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Can. Link Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal

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Oliver Mach. Co., Grand Rapids, Mich.

SANDERS
Oliver Mach. Co., Grand Rapids, Mich.

SAW BENCHES
Oliver Mach. Co., Grand Rapids, Mich.

SAW GUARDS
Oliver Mach. Co., Grand Rapids, Mich.

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Herbert Ltd., Alfred, Toronto, Ont.

SAWS SWING
Oliver Mach Co., Grand Rapids, Mich.

SMALL TOOLS
Herbert Ltd., Alfred, Toronto, Ont.

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Globe Engineering Co., Hamilton, Ont.

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Brown, Boggs, & Co., Hamilton, Can
Canada Machinery Corp., Galt, Ont.

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Oliver Mach. Co., Grand Rapids, Mich

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STEAM SEPARATORS AND TRAPS
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Sturtevant Co., B. F., Galt, Ont.

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Illingworth Steel Co., John. New York
Marshall, Son & Bunney, Toronto.

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Atkins & Co., Ltd., Wm., Sheffield, Eng
Firth & Sons, Thos., Montreal, Que
Latrobe Electric Steel Co., Latrobe, Pa
Lincoln Electric Co. of Canada, Ltd Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Peckovers, Ltd., Toronto, Ont.
Samuel Osborne (Can.), Ltd., Montreal
Vanadium-Alloys Steel Co., Pittsburgh

STEEL, CHROME MOLYBDENUM
United Alloy Steel Corp., Canton, Ohio.

STEEL CHROME VANADIUM
Norton, Ralph R., Agent, Montreal.
Atkins & Co., Ltd., Wm. Sheffield, Eng
Marshall, Son & Bunney, Toronto
United Alloy Steel Corp., Canton, Ohio.

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Firth & Sons, Ltd., Thos., Montreal,
Lyman Tube & Supply Co., Ltd., Montreal
Norton, Ralph R., Agent, Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng
Marshall, Son & Bunney, Toronto.
United Alloy Steel Corp., Canton, Ohio.

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Davidson Mfg. Co., Ltd., Montreal, Que.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Dom. Iron & Steel, Sydney, N.S.
Kennedy & Sons, Wm., Owen Sound
Electric Steel & Metals Co., Welland.
Nova Scotia Steel & Coal Co., Windsor.
Swedish Crucible Steel Co., Windsor.

STEEL, COLD DRAWN
United Alloy Steel Corp., Canton, Ohio.

STEEL, COLD ROLLED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Drawn Steel Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

STEEL, ELECTRIC FURNACE
United Alloy Steel Corp., Canton, Ohio.

STEEL FJAB
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.

STEEL, NICKEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
United Alloy Steel Corp., Canton, Ohio.

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Wm. Atkins & Co., Sheffield, Eng.
Can. Fairbanks-Morse Co., Montreal
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
H. A. Drury Co., Ltd., Montreal.
Firth & Sons, Thos., Montreal, Que.
Illingworth Steel Co., J., New York.
Latrobe Electric Steel Co., Latrobe, Pa.
Marshall, Son & Bunney, Toronto, Ont.
Osborne, Samuel, Montreal, P.Q.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

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United Alloy Steel Corp., Canton, Ohio.

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United Alloy Steel Corp., Canton, Ohio.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie
MacKinnon Steel Co., Sherbrooke, Que.
Peckovers, Ltd., Toronto, Ont.

STEEL, TOOL
Armstrong, Whitworth of Can., Montreal
Atkins & Co., Wm., Sheffield, Eng.
Can. Fairbanks-Morse Co., Montreal.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Co., H. A., Montreal, Que.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Firth & Sons, Thos., Montreal, Que
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont.
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Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh.

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Armstrong, Whitworth of Can., Montreal.
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Bertrams, Ltd., Edinburgh, Scotland.

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Page Steel & Wire Co., Adrian, Mich.

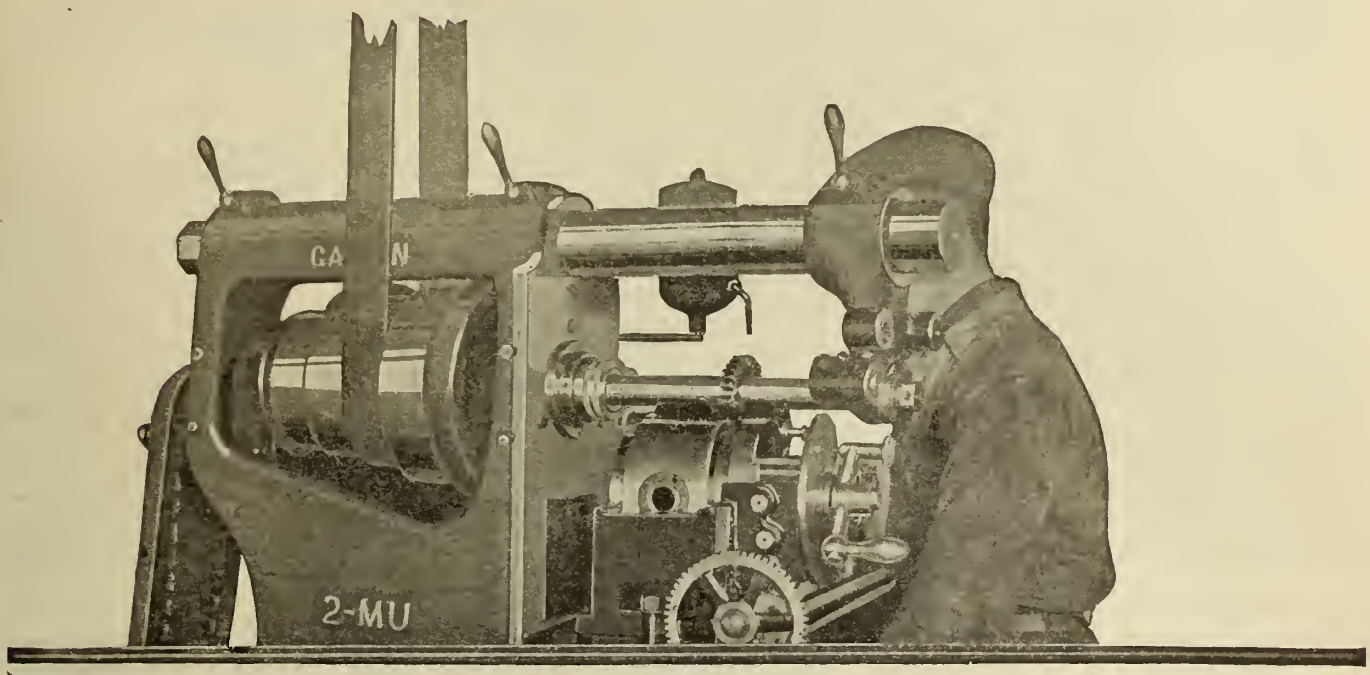
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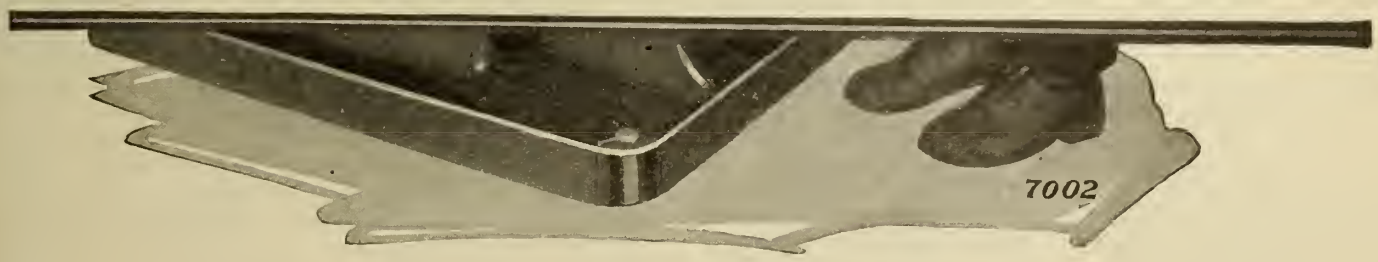
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Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

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Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Williams Hamilton Co., Peterboro, Ont.

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Galt Machine Screw Co., Ltd., Galt, Ont.

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Rice Lewis & Son, Toronto, Ont.

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Landis Machine Co., Waynesboro, Pa.
Murchy Machine & Tool Co., Detroit.
Niles-Bement-Pond Co., New York.
National-Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
L. S. Starrett Co., Athol, Mass.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

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Geometric Tool Co., New Haven.
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Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Pilot Steel & Tool Co., Montreal, Que.
Victor Tool Co., Waynesboro, Pa.

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Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

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Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE SCREW
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

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Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
Wells Bros. of Can., Galt, Ont.

TAPS, STAYBOLT, TAPPER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

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Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Fuss Mchy. & Sply. Co., G. F., Montreal.
Geometric Tool Co., New Haven.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Morse Twist Drill & Mchy. Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Strelinger, Chas. A. Co., Windsor, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto.
Wells Bros. of Canada, Galt, Ont.

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Taylor Instrument Co., Rochester, N.Y.

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Garlock-Walker Mach. Co., Ltd., Toronto
Geometric Tool Co., New Haven.
Jardine & Co., Ltd., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.
National Machy. Co., Tiffin, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt., Ont.

THREADING TOOLS
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Greenfield
Landis Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y

THREADING MACHINES FOR BOLTS, NUTS AND PIPES
Greenfield Tap & Die Corp., Greenfield
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt., Ont.

THUMB SCREWS AND NUTS
See Screws.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

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British Smelting & Refining Co., Ltd. Montreal, Que.
Hoyt Metal Co., Toronto, Ont.

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Petrie, Ltd., H. W., Toronto.

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Jardine & Co., Ltd., A. B., Hespeler.

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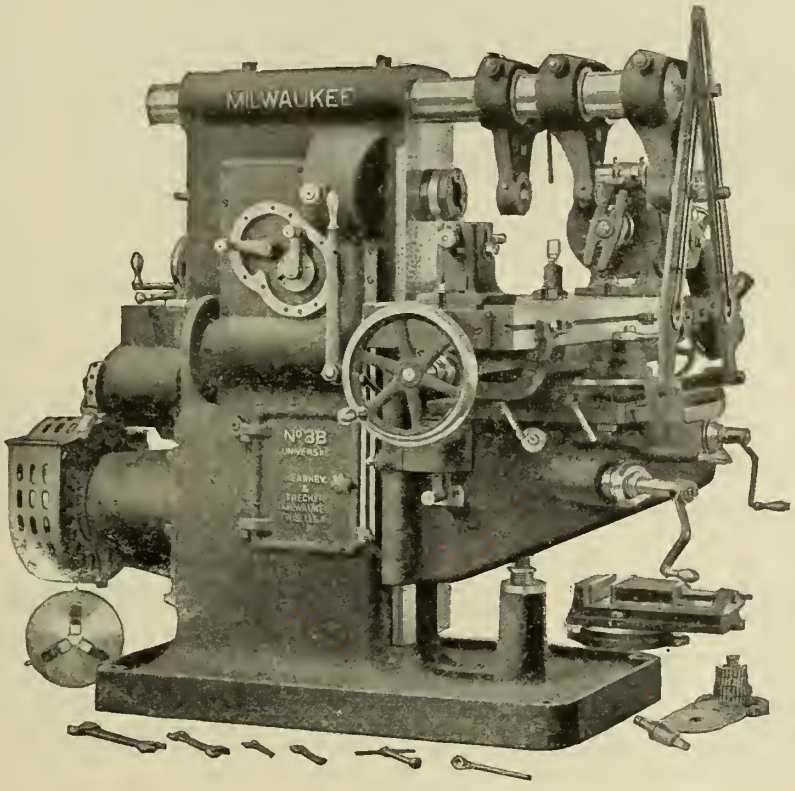
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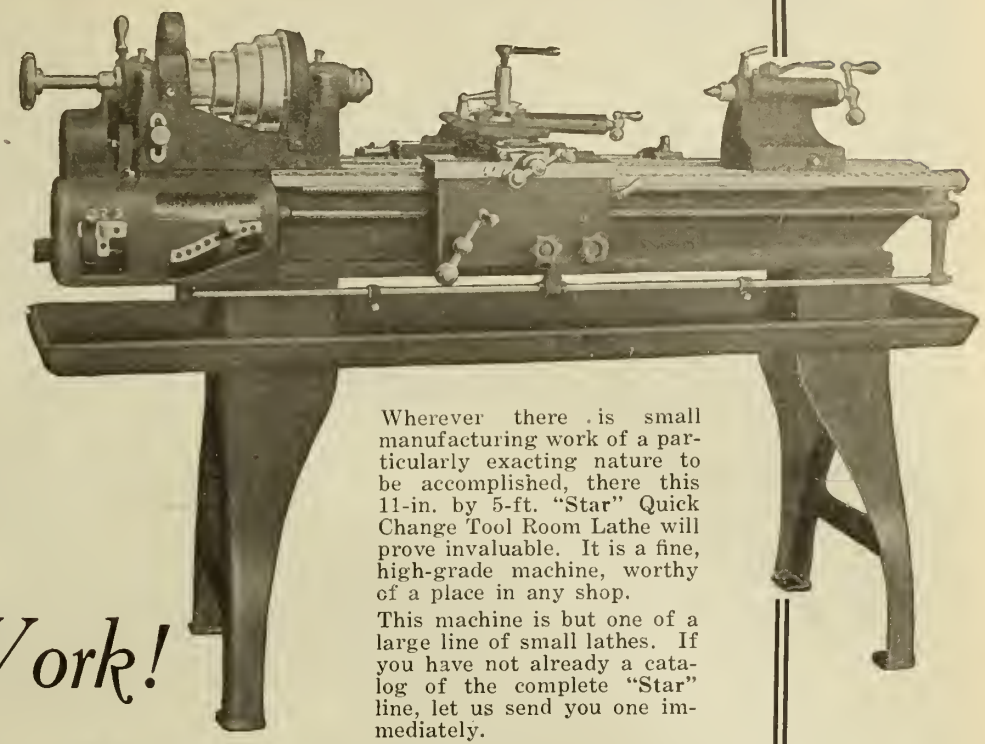
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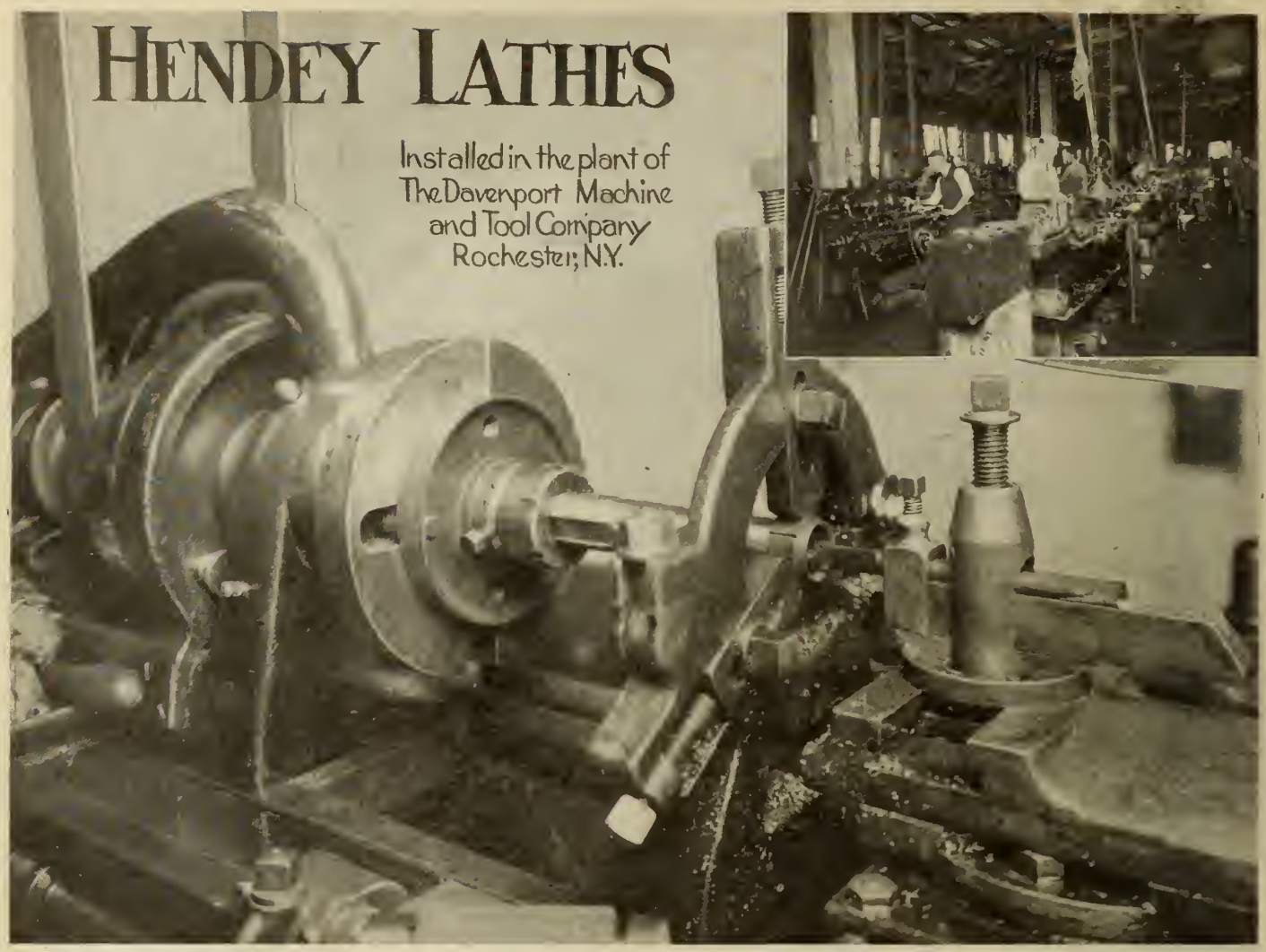
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Installed in the plant of The Davenport Machine and Tool Company Rochester, N.Y.



An Accurate Production Job

A PRODUCTION job requiring great accuracy is a **real** test for a lathe. Here is one which proves the merit of the Hendey.

It is a small plate face job—machining a Davenport inner spindle into which the chuck is screwed. The operations consist of recessing, threading, turning and boring. Nine hours only are allowed for twenty-five fully finished pieces.

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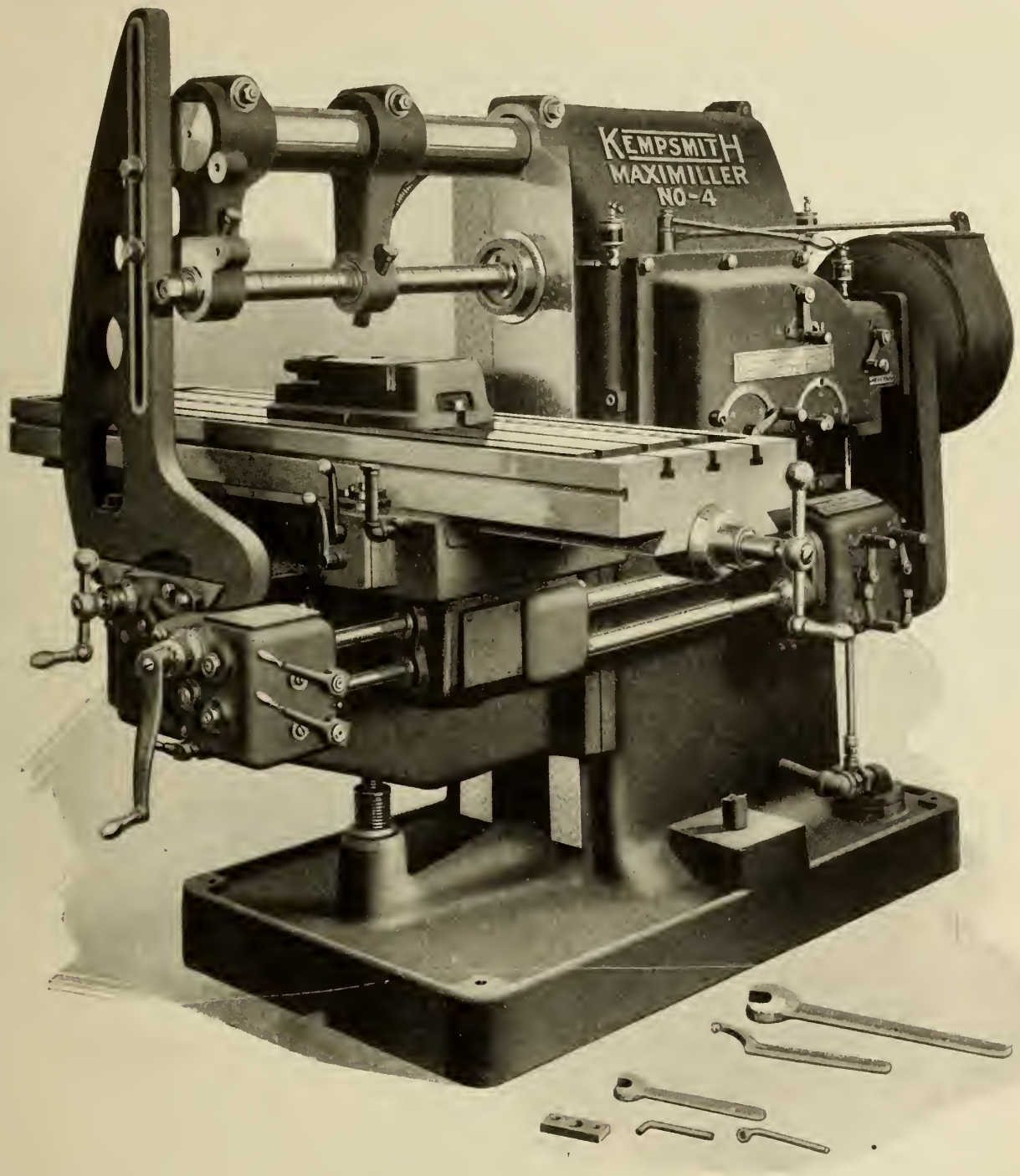
Always the purchase of one Hendey means the purchase of more. Remember this when in need of lathes, shapers and milling cutters.

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Single Pulley Drive

Equipment.—1¾-inch arbor, two arbor supports, brace, No. 4 Plain Vise and all necessary crank-handles, wrenches, and accessories as shown.

The Kempsmith No. 4 Plain Maximiller has been designed in recognition of the growing demand for a heavier and more powerful machine than the usual cone type miller. It is the product of some twelve years' experimentation by an experienced and thoroughly seasoned organization. In all features of general design, such as weight, rigidity, convenience of operation and efficiency in production we offer this machine as the maximum milling machine of similar rating.

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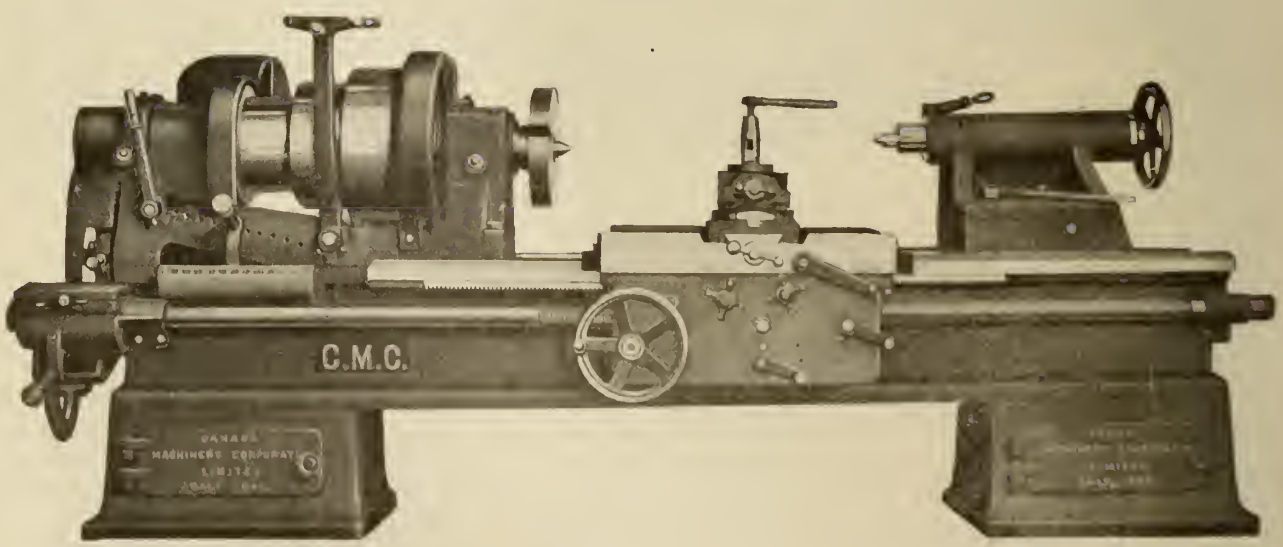
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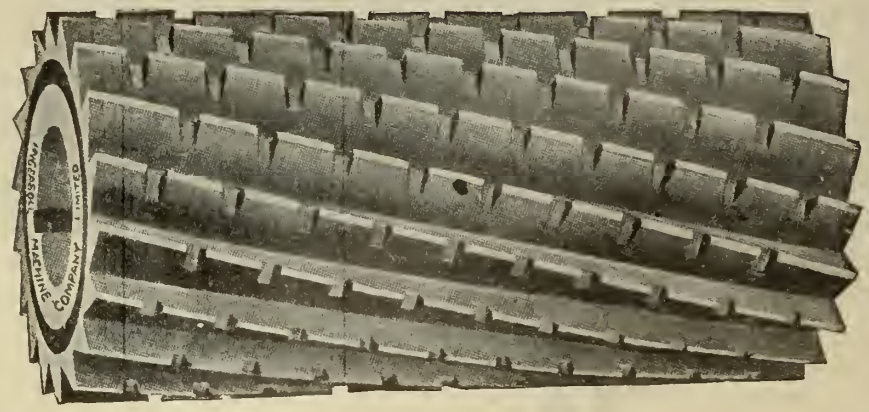


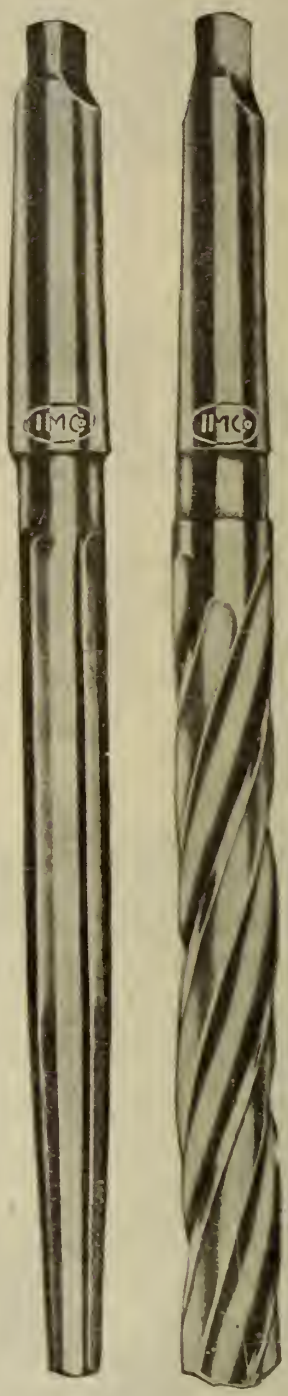
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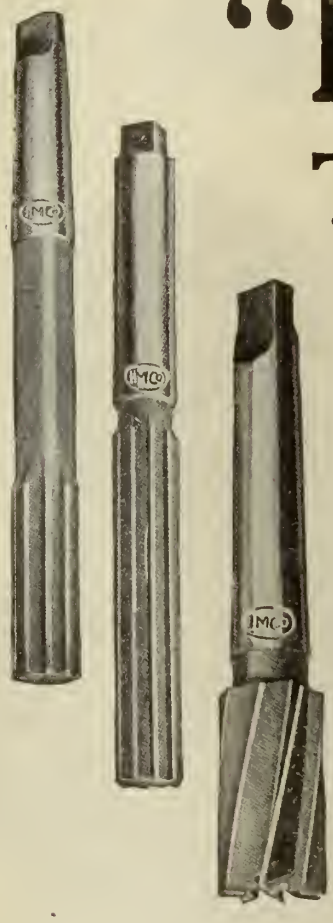
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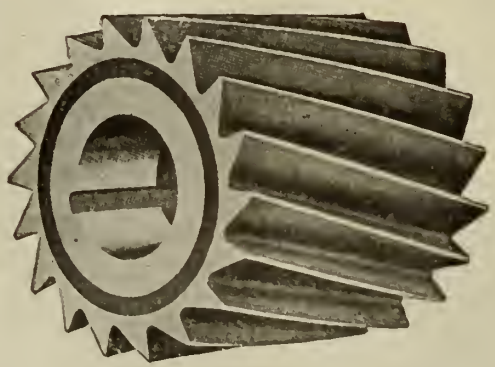


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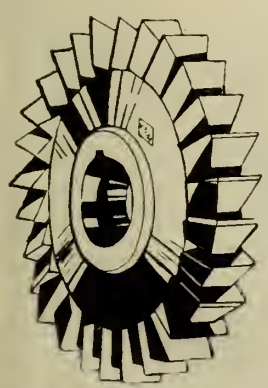
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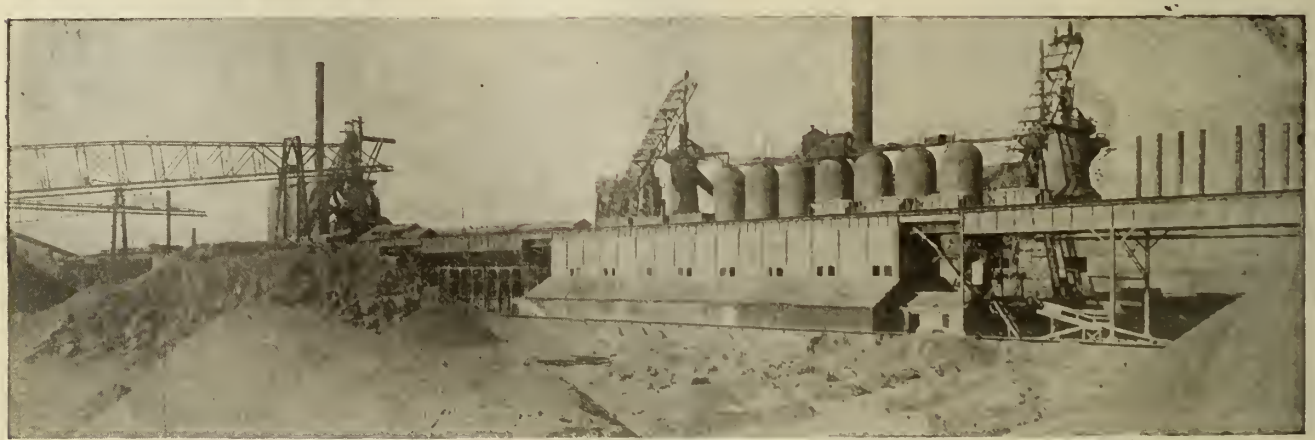
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We will be glad to demonstrate the new method to you in our showrooms.

Copy of our technical treatise, "Cutting Tools," will be gladly sent on request.



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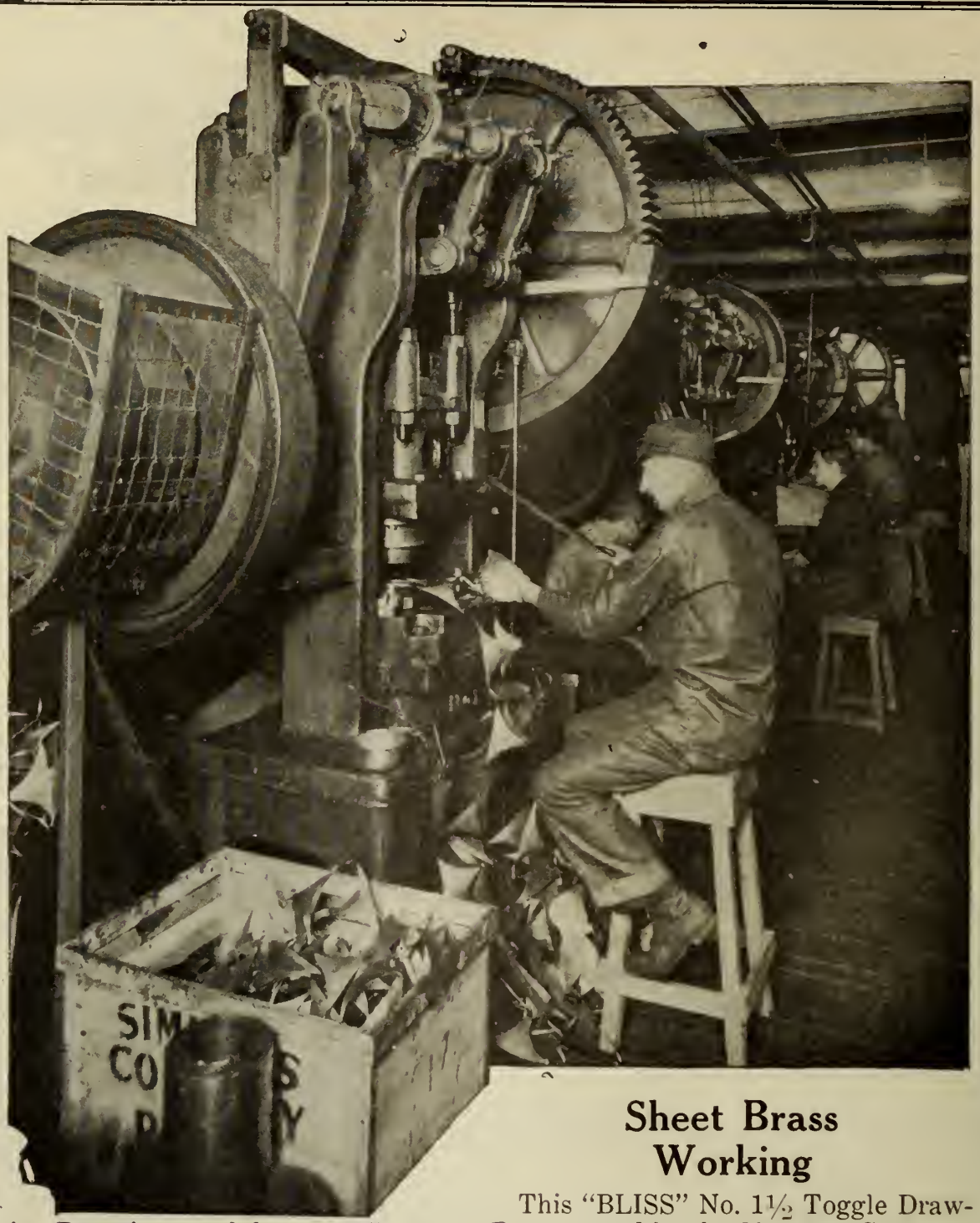
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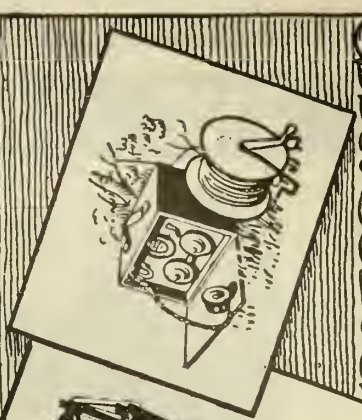
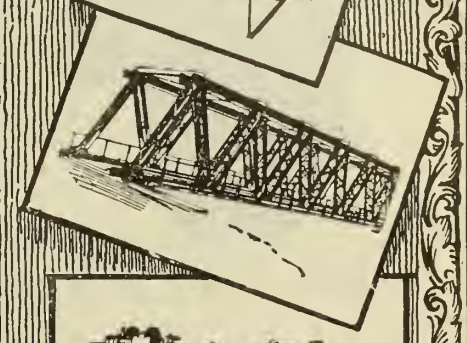
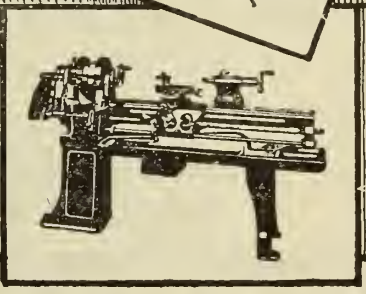
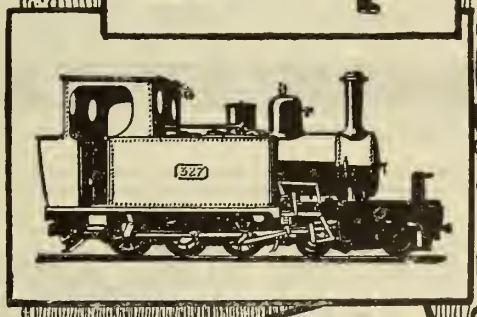
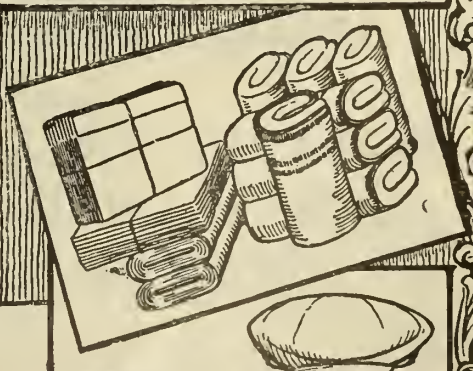
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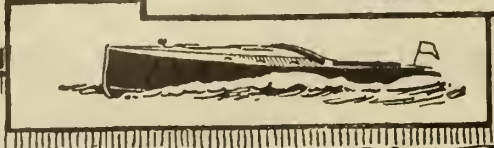
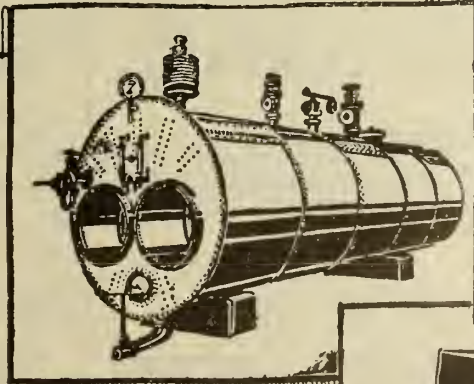
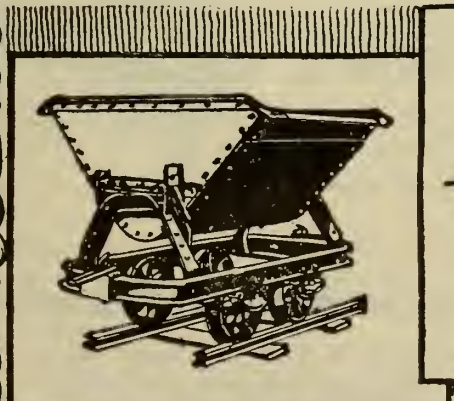
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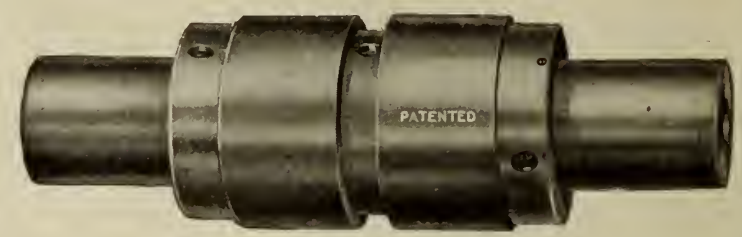


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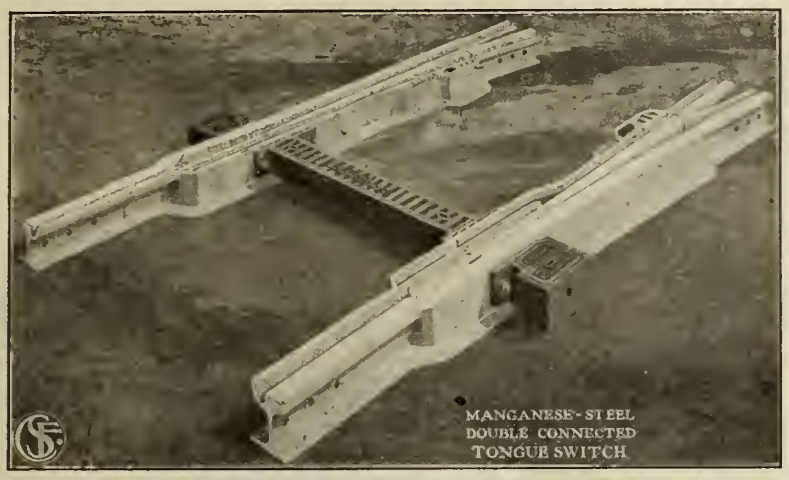
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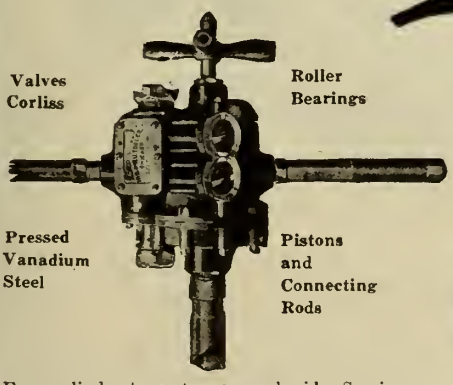
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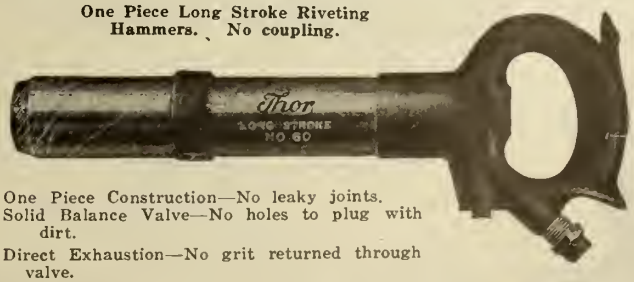
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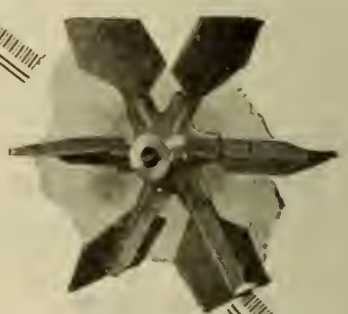
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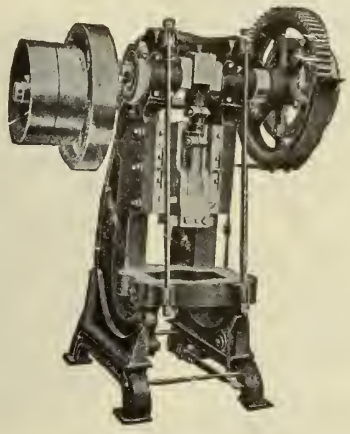
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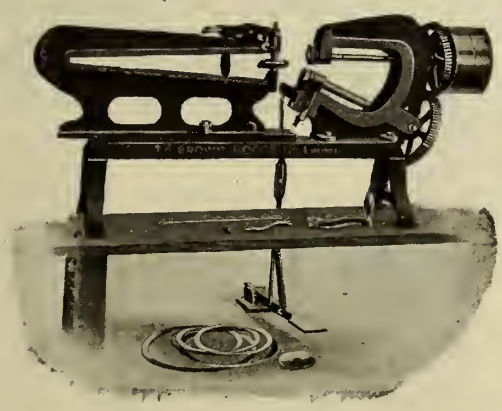
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We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open-Hearth Steel on the Shortest Notice.

Nova Scotia Steel and Coal Co., Limited

Head Offices:
New Glasgow, N.S.

Sales Offices:
Western Room 14 Windsor Hotel
MONTREAL



Steel Ingots
by the
HARMET
Liquid Process

STEEL CASTINGS

QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½ lb. to 5,000 lbs. each

THE WILLIAM KENNEDY & SONS,
LIMITED
OWEN SOUND, ONTARIO
ESTABLISHED 1860

STEEL CASTINGS

We shall be glad to supply information on:

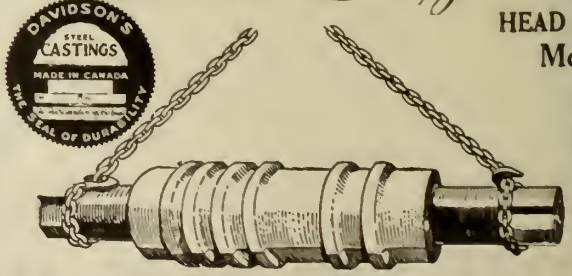
Galvanizing, Enamelled Signs, Stoves, Lithographed Ware, Wire Goods, Anchors, etc.

For Shipbuilding, cars, locomotives and all classes of machinery.

Superior and reliable Steel Castings by the Acid Electric Process can be made up to fifteen tons.

The Thos Davidson Mfg. Co Limited

HEAD OFFICE:
Montreal



Branches:
Toronto and Winnipeg
Steel Foundry Division
Lachine Canal
Turcot.

DAVIDSON

FIRTH'S

DEPENDABLE TOOL STEELS

"A STEEL FOR EVERY TOOL"

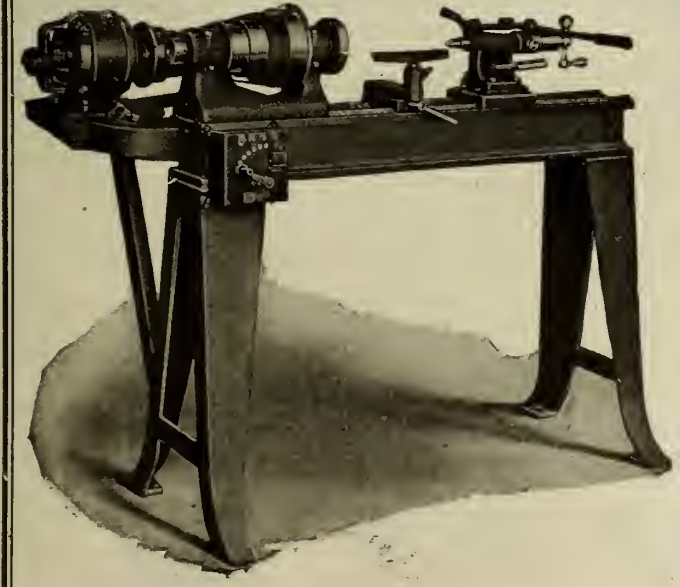
SPEEDICUT *High Speed Steel*
EXTRA *Cast Steel*
BEST *Cast Sheet Steel*
BEST *Cast Chisel Steel*

"FIRTH QUALITY MEANS FIRST QUALITY"

ALSO

NICKEL-CHROME STEEL, MINING AND QUARRYING STEELS

THOS. FIRTH & SONS, LTD. SHEFFIELD, ENG.
449 ST. PAUL ST. W., MONTREAL
79 ADELAIDE ST. W., TORONTO
JOHN J. COLEMAN
CANADIAN MANAGER



Built For *Service*

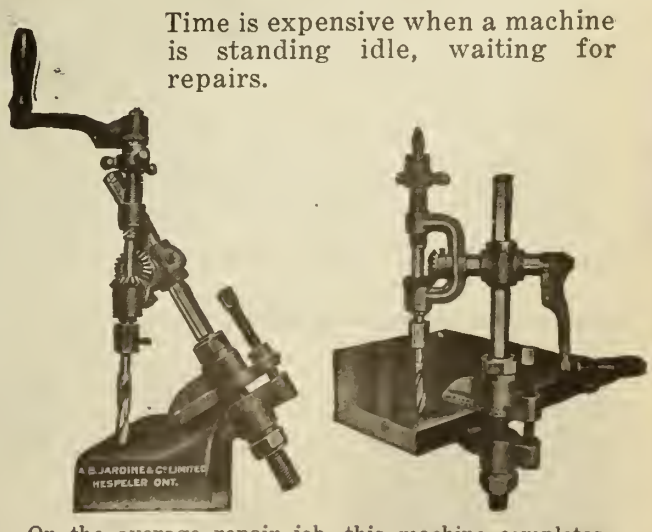
This BLOUNT Motor-driven Lathe is well adapted to all speed lathe uses. It is of late design, and has a number of features in which you will be interested. Provided with constant-speed motor. Lathe spindle made of hollow, high-carbon steel, ground to size and bored for Morse taper. Runs in self-oiling bronze bearings.

"We will accept Canadian funds at par"

J. G. Blount Co., Everett, Mass., U.S.A.

Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited
HESPELER, ONTARIO

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HIGH SPEED A.W. CARBON ALLOY STEELS

MADE IN CANADA

Involute Gear Cutters
Screwing Apparatus
Twist Drills
Chasers
Taps and Dies

Milling Cutters
Reamers
Broaches
Rivet Snaps, etc., etc.

Armstrong, Whitworth of Canada, Limited
MONTREAL TORONTO HAMILTON WINNIPEG

FROST KING BABBITT

will withstand heavy pressure without increasing its temperature.

For general machinery bearings it is without a peer.

If you are from Missouri try a sample lot and be convinced.



HOYT METAL COMPANY
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MacKINNON STEEL CO., LTD.

Engineers, Manufacturers and Erectors of Steel Structures

Industrial Bridges, Buildings, Towers, Smoke Flues and Stacks, Chutes, Coal Bins, Ore Bins, Tanks, Cranes, Engine Houses, Grain Elevators, Derricks.

Structural Steel and Steel Plate Work, and a combination of the two lines.

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Don't Handle It—CONVEY IT

Manufacturing is more than putting raw materials through machines. The handling and transferring of materials from one machine or department to another enters into production costs just as much as machine operations.

You invest in machinery that will enable you to shave costs even slightly. Why not invest in equipment which, in many cases, cuts handling costs 50 to 75 per cent.?

Link-Belt Conveyors transport finished or raw materials at the lowest possible cost at factory mill or wharf—anywhere indoors or out. In many cases they are the pace makers for the operation of entire factory departments. There's a Link-Belt Conveyor for every purpose. Write us. Let us send you our Conveyor Book. 223



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ELEVATORS AND CONVEYORS

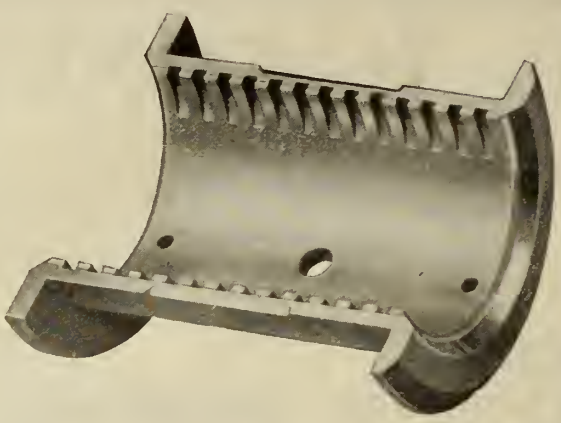
We Also Make

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- [ ] Chains and Sprockets
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Write for Catalogs
Place X in Square

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BABBITT LINED BRONZE BEARINGS FOR INTERNAL COMBUSTION MOTORS





DIE CASTINGS

DOEHLER PROCESS

Manufactured by



Tallman Brass & Metal Limited

HAMILTON, ONT.



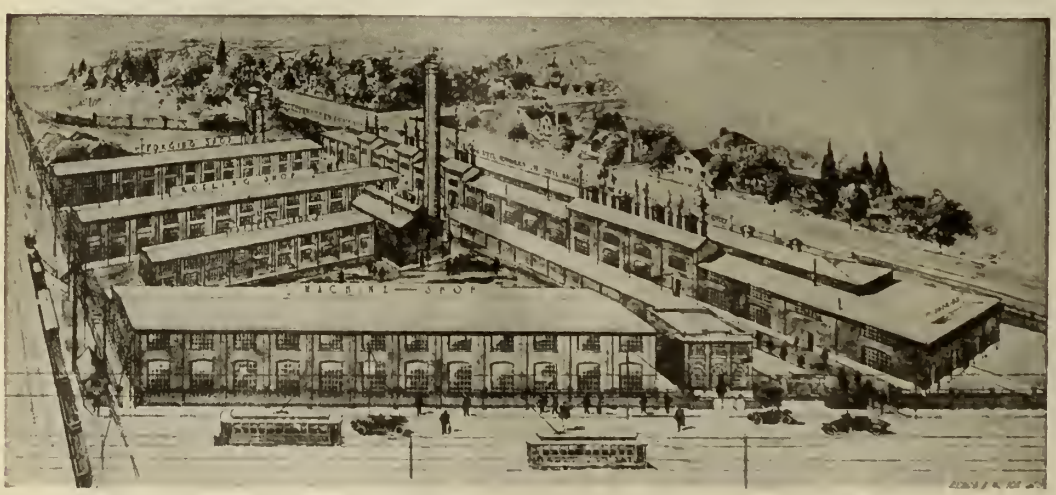
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Foundries, Limited *Hull, Quebec*

Steel, Chrome, Manganese and Nickel Steel Castings

Annealed and Unannealed

Cement Mill and Mining Machinery Castings, Stamp Mills, Crushing Plants, Excavating Outfits, Steel Car Wheels, Locomotive Driving Wheels and Frames, etc.

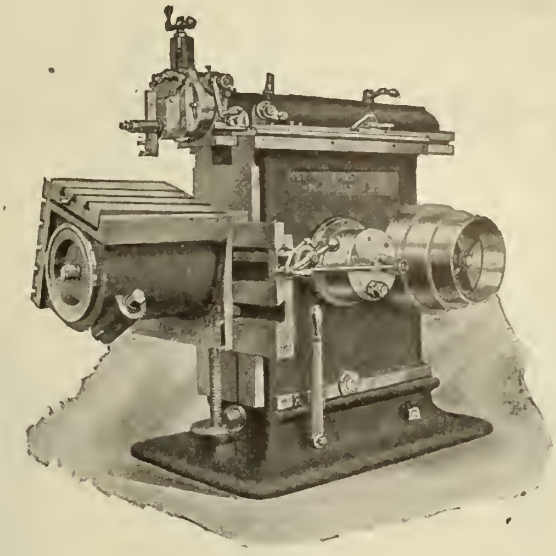


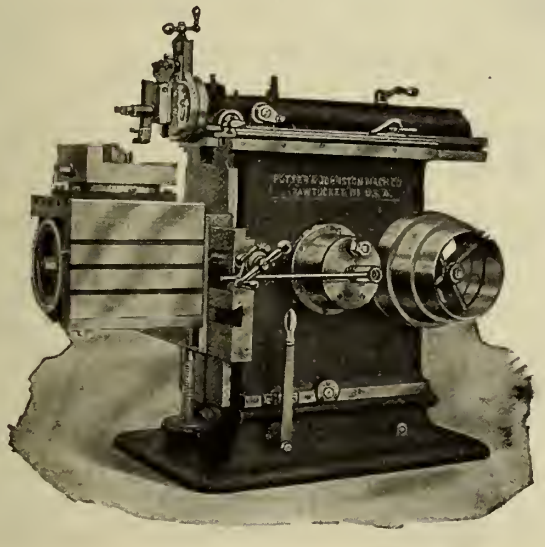
Machine-Moulder Gears

"H I S C O" machine-moulded gears, while requiring no pattern, insure accuracy, dependability, quality, and the price is minus the cost of patterns—which in these days of high prices of lumber is something to be considered.

Specify "HISCO" Products

Universal Shaping Machines





NO special vises or fixtures needed; the Universal features of these machines take care of everything, making them particularly adapted to—
Die Work
Tool Making and
General Manufacturing.

Machines regularly furnished with—
Swivelling Graduated Table.
Auxiliary Tilting Side for Compound Angles.
Power Down Feed on any angle, with any variation of feed.
Automatic Feed Stop.
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Table raised and lowered by power on 24-inch size.

Canadian Offices: **POTTER & JOHNSTON MACHINE CO.**

ROELOFSON MACHINE & TOOL CO., LIMITED

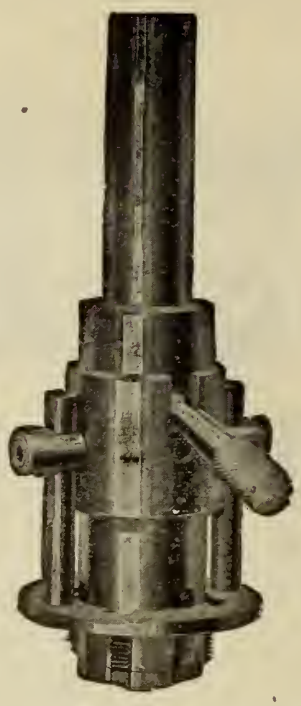
Head Office and Show Rooms:
11 Wellington Street East - TORONTO, CANADA

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Maximum Production

Minimum Expense

MURCHEY AND TAPS DIES



Murchey Tools will boost your production fifty per cent. They do quicker, better work than ordinary tools, and last longer. Every tool that comes out of the Murchey shops is as good as it is possible to make it.

Murchey Taps and Dies will cut your production expenses in half.

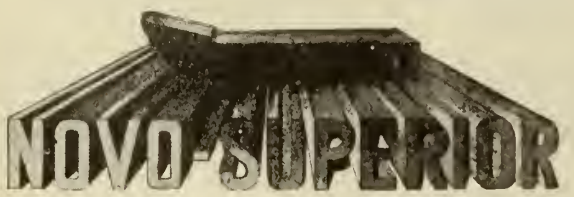
Send for a Murchey Tap and Die on approval. A trial in your own shop under your own conditions will demonstrate their value to you.

MURCHEY

Machine and Tool Company
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THE COATS MACHINE TOOL CO.
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HIGH SPEED STEEL
INTRA STEEL GIBRALTAR STEEL
Tool Steel for Every Purpose
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Twist Drills, Taps, Hack Saw Blades, Milling Cutters, Files, Etc., Music Wire for Springs, Steel Balls. Cold Rolled Tool Steel in Strips and Sheets, Circular Saws, Machine Knives.

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Sole Agents for

JONAS & COLVER, LIMITED
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H. BOKER & CO., Inc.
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Manufacturers:

The Sheffield Twist Drill & Steel Co., Ltd,
Works: Summerfield Street, Sheffield

To PROMOTE TRADE within the EMPIRE, CANADIAN MANUFACTURERS will find that "DORMER BRAND DRILLS" meet all requirements. QUALITY DRILLS for quick drilling—USE "DORMER."

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High Speed Twist Drills

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

Announcing

the issuance of a new catalog of prime interest to all users of milling and gear cutters and small tools. Herein you will find listed styles and sizes of end mills (special and plain) T-slot cutters. Key cutters, thread mills, gear slots—in fact your needs in the small tool line of this class are sure to be covered. Get your copy and note its completeness.

If your special requirement doesn't appear, Bilton can produce it—and in true Bilton Quality.



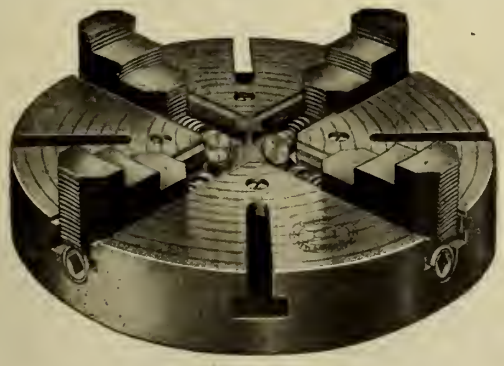
Just sign your name and address on a card and post it to

The Bilton Machine Tool Company
Housatonic Ave., Bridgeport, Conn.

ALL STEEL

INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



THE UNION STEEL BODY CHUCKS

are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

UNION MANUFACTURING COMPANY
New Britain, Conn.
New York Office: 26 Cortlandt Street
Makers of a complete line of chucks

GREY IRON CASTINGS

Also

Brass, Bronze and Aluminum Castings

Nickel, Zinc and Copper Castings for Anodes

QUALITY !
SERVICE !

Canadian Hanson Van Winkle Co.
Limited
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Namco
SCREW MACHINE
products

SPECIAL

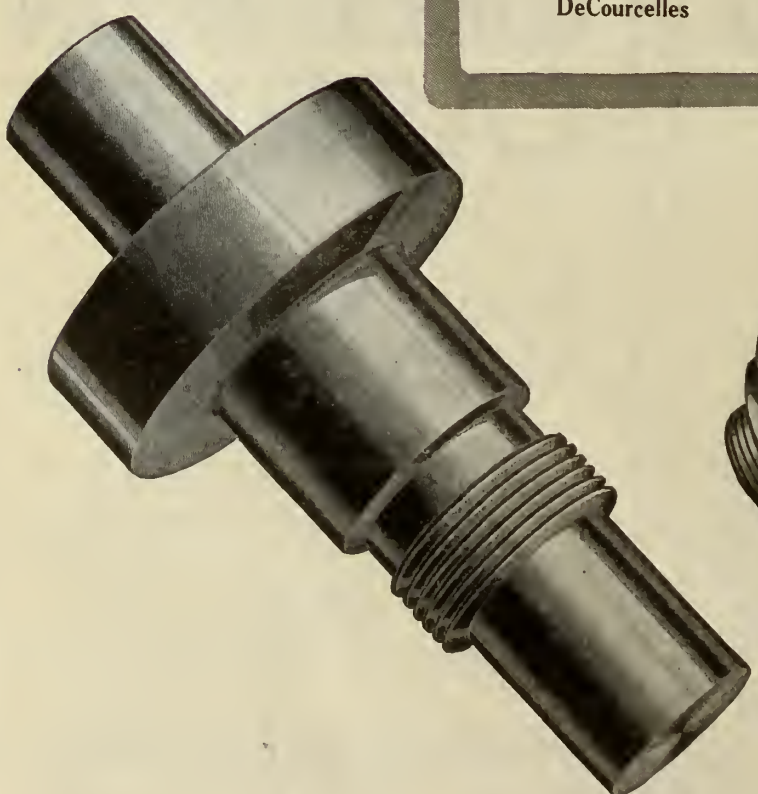
Special Screw Products
To Specifications
Capacities up to 2¼ in. diam.

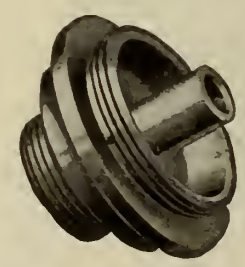
STANDARD

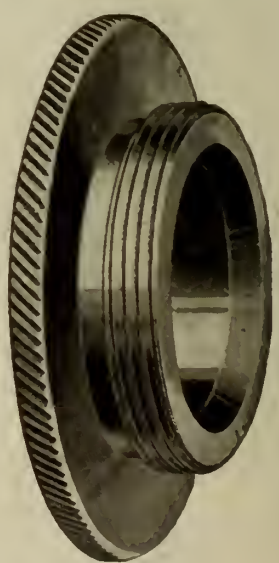
V., S.A.E. and U.S.S. Cap Screws
V., U.S.S. Semi-Finished Nuts
S.A.E. Plain and Castellated Nuts
V., U.S.S. Set Screws

Owing to the market shortage of raw material, it is to the customers' advantage that they anticipate requirements as far ahead of use as possible.

THE NATIONAL ACME COMPANY
MONTREAL, P.Q.
DeCourcelles G.T.R.R.







40 Years of Progress with Fine Tools

"--when old Dobbin was the motor."

Even in 1880, in the days when old Dobbin was the motor, machinists had learned to rely on Starrett Tools for long service and measurements of unvarying accuracy.

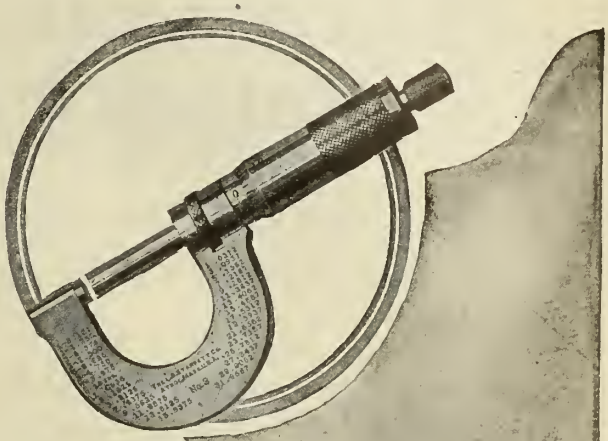
So the first automobile factories to be established found skilled workmen ready to carry out the inventors' plans—with the help of Starrett Tools.

Starrett Tools are linked inseparably with the marvelous growth of the automobile industry. They have helped to make it possible. In the great automobile factories of today—in every shop where metal is worked to the closest limits of tolerance—skilled mechanics know and prefer Starrett Tools.

The Starrett Catalog No. 22 "3" is a useful reference book. Write for a free copy.

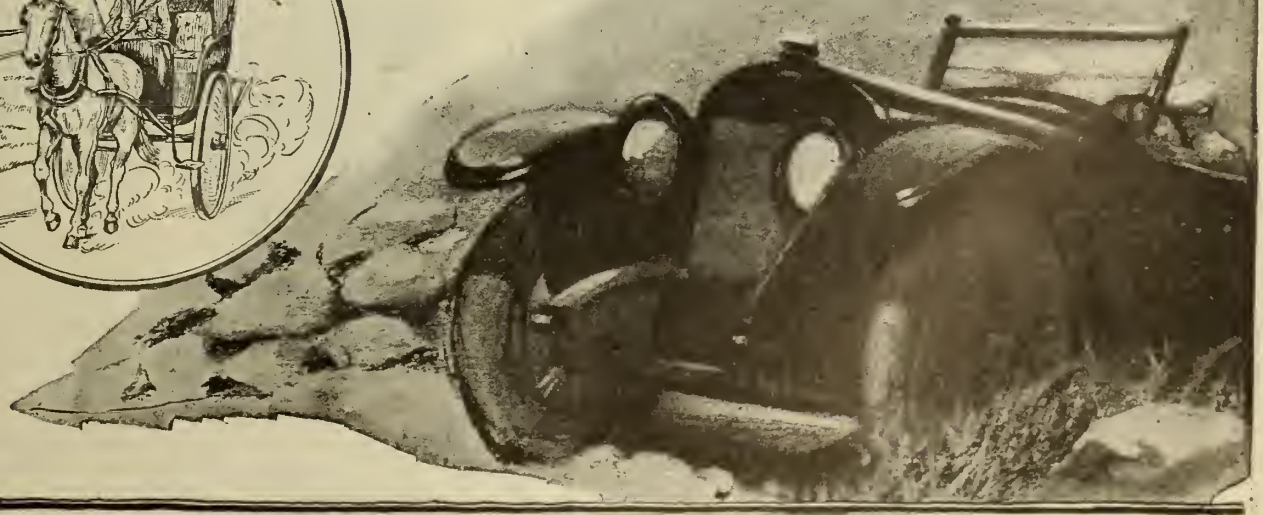
THE L. S. STARRETT COMPANY

The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.





1920



Use Starrett Tools

STARRETT TOOLS — STARRETT HACK SAWS CUT QUICKER LAST LONGER

42-117

If interested tear out this page and place with letters to be answered.

Sharpness, Hardness and Balance

These are the three important things about a file:

Keen, properly set teeth; steel thoroughly hardened; a distribution of weight that makes for ease of handling.

The following brands have all these qualities to such a degree that they have become the standard of file quality. Specify one of them when ordering:

Kearney & Foot
Great Western
American
Arcade
Globe

FILES

Made in Canada by

Nicholson File Company

Port Hope - Ontario



TRAHERN Circulating Pumps

Insure the continuous co-operation of your machines by equipping them with Trahern Geared Circulating Pumps.

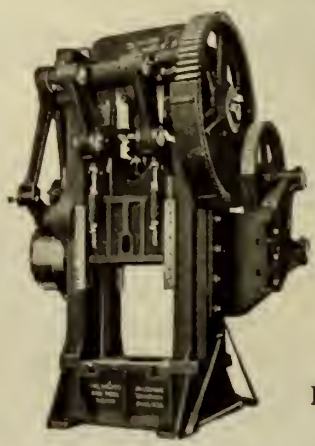
Trahern Pumps have large capacity, low speed and long life —all superior essentials.

Bulletin No. 44 upon request.

TRAHERN PUMP DIVISION
GEO. D. ROPER CORPORATION
Rockford, Illinois, U.S.A.

We are Building

The "TOLEDO" Patented Toggle Drawing and Deep Stamping Presses



in all sizes, from the smallest to the largest, in both the single and double crank types.

Their Superior Merits Have Been Recognized

by many of the largest press users.

With our new foundry now in operation we are prepared to make ATTRACTIVE DELIVERIES.

Correspondence Solicited — Estimates Furnished

The Toledo Machine and Tool Co.
TOLEDO, OHIO, U.S.A.



STRENGTH

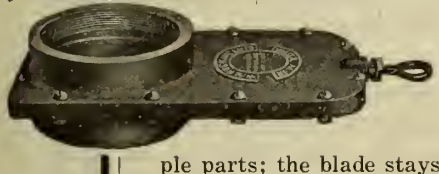
Strength is a very essential quality in a wrench, but it does not depend entirely upon bulk or weight of metal. The strength and long-lasting qualities of Armstrong Wrenches are the result of skilled combination of the Best Steel, Expert Design, Accurate Machining, and Heat Treatment. All kinds and sizes.

Write for free catalogue.

Armstrong Bros. Tool Co.
"The Tool Holder People"
335 N. Francisco Ave., Chicago, U. S. A.

New Air-Tight Blast Gates

will help you maintain the safety, economy and efficiency so essential in the operation of furnaces and other appliances using low or moderate pressure air.



THEY ARE SAFE—because they are ruggedly built of only a few simple parts; the blade stays fixed in any position and by a slight pull of the handle is easily adjusted to give the blast desired.

THEY ARE ECONOMICAL—because the initial cost is small; the simple construction eliminates wear and tear.

THEY ARE EFFICIENT—because careful machining makes them AIR-TIGHT; they afford the full area of the blast pipe, in striking contrast to a stop cock; they are quick in operation; they can be placed in any position.

In short, these New Air-Tight Blast Gates possess all the advantages of stop cocks and valves, and have special features that tend for greater usefulness and economy.

SIZES 2" TO 16"

Write for Bulletin 210-T

W. S. ROCKWELL COMPANY
Furnace Engineers and Contractors
50 Church St., New York

Canadian Distributers:
Drummond, McCall & Co., Limited, Montreal

THE MASTER METAL

STELLITE

Not steel---but its master

The results which other firms secure from **Stellite** prove conclusively its possibilities.

This is what Beatty Bros., Limited, tell us—

"Since adopting **Stellite** we have increased production from 10% to 40%. We highly recommend it in preference to any steel for cutting."

Such testimonials as this are by no means unusual. The shops throughout Canada which are securing production increases as high and higher than this run into the many hundreds.

We have a booklet containing a partial list of these concerns. Shall we send you a copy?

Deloro Smelting & Refining Co., Limited

Head Office and Works:
DELORO CANADA

Branch Warehouses:
200 King St. W., Toronto, Ont., Can.
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THE MASTER METAL

300 sizes and types—all modern



EVERY air power user, no matter how large or how small his requirements, is able to secure a compressor best meeting his needs from the Chicago Pneumatic line, *most complete* because it consists of over 300 distinct types and sizes

EVERY Chicago Pneumatic, regardless of size or type, is of *modern* design and construction throughout—the last word in compressor manufacturing progress. The Simplate flat-disc indestructible valve is *one* C-P feature. Know *all* of them. Ask for Bulletins

Sales Representatives

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Canadian Factory: Canadian Pneumatic Tool Company, Montreal

C-83 H

BOYER PNEUMATIC HAMMERS · · LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
CHICAGO PNEUMATIC AIR COMPRESSORS · · VACUUM PUMPS · · PNEUMATIC HOISTS,
GIANT OIL AND GAS ENGINES ROCK DRILLS · · COAL DRILLS

CHICAGO PNEUMATIC

Depend upon *that Name*



Why Use Clamps, Bolts, Nuts, Vises, To Hold Your Work?

They Weigh 250 Pounds

Hold with a HEALD *and be sure*

The Holding Surface is 1½ sq. inches

By actual test the Heald Magnetic Chucks will pull from 110 lb. per square inch to 200 lb., depending upon the size of the chuck. The size shown above is style 1224 and holds machine steel 200 lb. per square inch.

Not only does the Heald Chuck reach a maximum in holding power, but it is absolutely waterproof—does not magnetize the machine or tools it is used with, while the voltage can be easily changed from 110 to 220 and its construction is such it is practically indestructible.

Rotary sizes from 6 in. to 24 in. dia. Rectangular, 4 x 10 in. to 14 x 36 in.

Heald Chucks can be used on grinders, millers, planers or lathes, and photos showing application of them at work on these machines will be sent to any address on request.

Write for Literature Magnetic Points and Bulletin

THE HEALD MACHINE COMPANY

Worcester, Mass.

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SOMETHING TO REMEMBER—

when you see a tool marked



M.T.D. & M.CO.

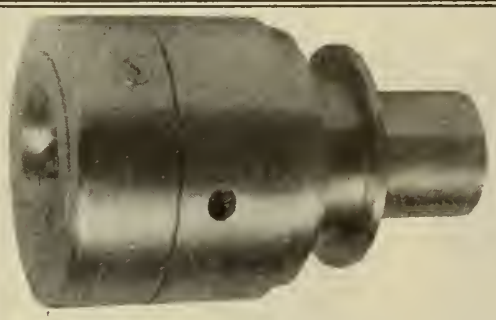
IT SIGNIFIES

A DEPENDABLE TOOL

AND

SUPERIOR SERVICE

Morse Twist Drill & Machine Co.
New Bedford, Mass., U.S.A.



No. 2. TYPE "R"
Hartness Automatic Die

WITH SHANK FOR REVOLVING SPINDLES

These dies are designed for use on either vertical or horizontal spindles. Die is re-locked by forward motion of sleeve, which may be actuated by a yoke working in the groove or by a fixed stop making contact with rear edge of sleeve at the return stroke. Die is unlocked in the usual manner by retarding its forward motion or by a fixed stop, making contact with the external tripping button shown on the face of the die. External tripping button is especially desirable in cutting very short threads as it relieves the thread of the strain incidental to unlocking by the pull-off device.

The diameter of the No. 2, Type R die is 3 3-16 in., and its length as shown is 3½ in.

The Die cuts both right and left-hand threads ½ in. to 1 in. in diameter, and from 10 to 40 threads per inch.

Shanks are varied to meet individual requirements.

A set of standard chasers in carbon steel is supplied gratis with each Die.

No tools of any kind need be used in changing chasers.

A chaser grinding jig is supplied gratis on Die orders if desired.

Jones & Lamson Machine Company
(DIE DIVISION)

9-10 Water Lane, Queen Victoria St., LONDON, ENGLAND. — **SPRINGFIELD, VERMONT, U.S.A.** — **503 Market St., SAN FRANCISCO, California, U.S.A.**

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Boyer, Campbell Company, Detroit.

E. L. Essley Machy. Co., Chicago, Milwaukee and Moline.

Robinson, Cary & Sands Co., St. Paul and Duluth.

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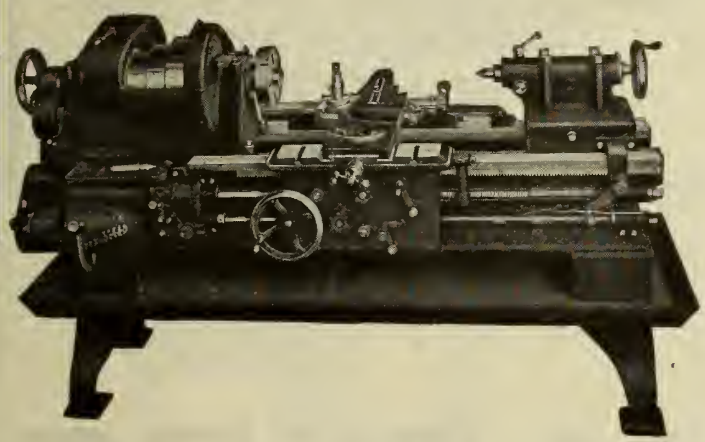
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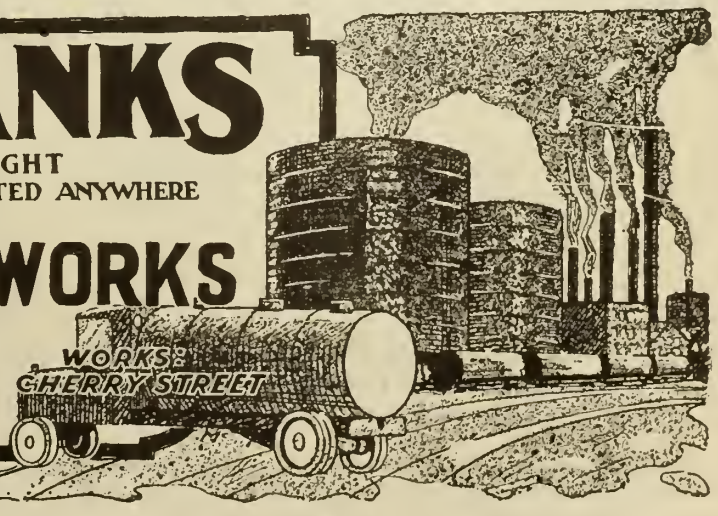
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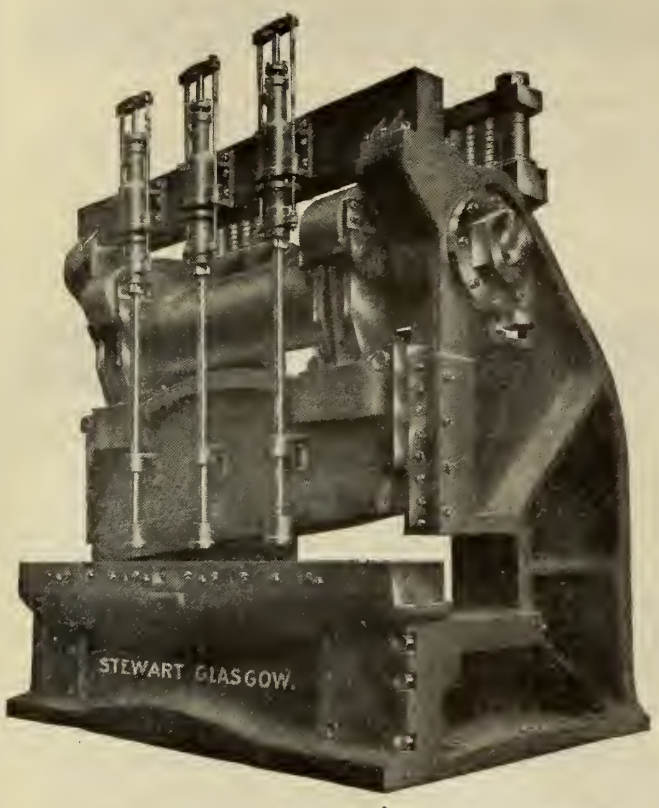
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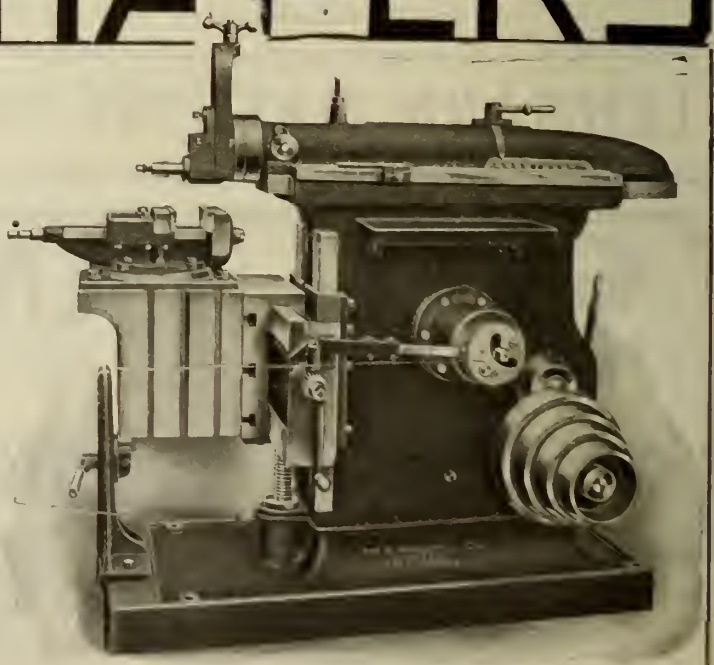
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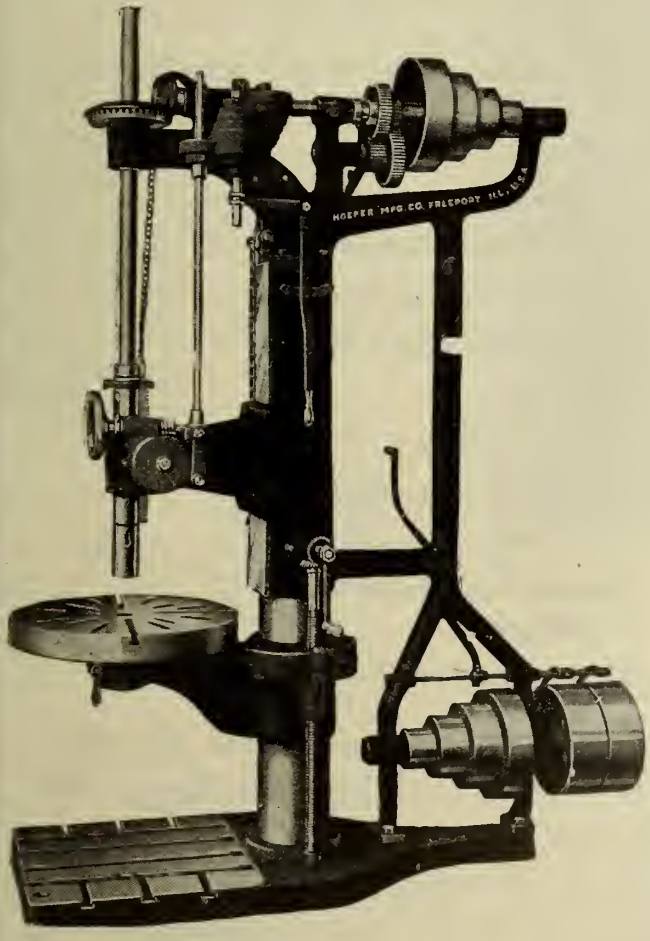
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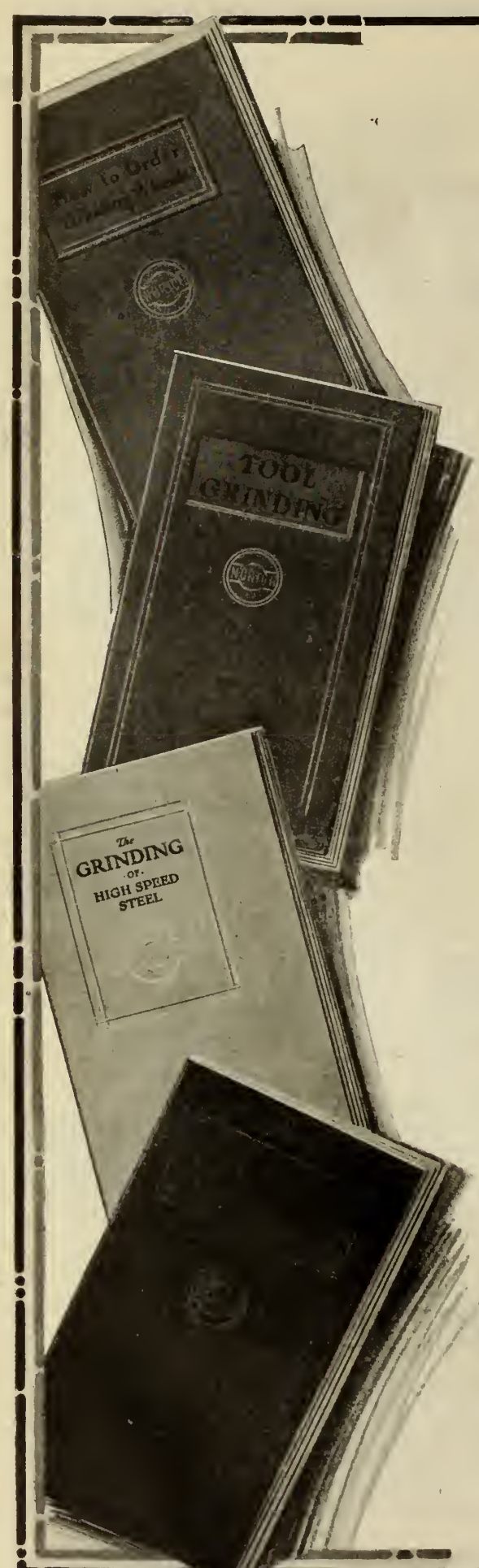
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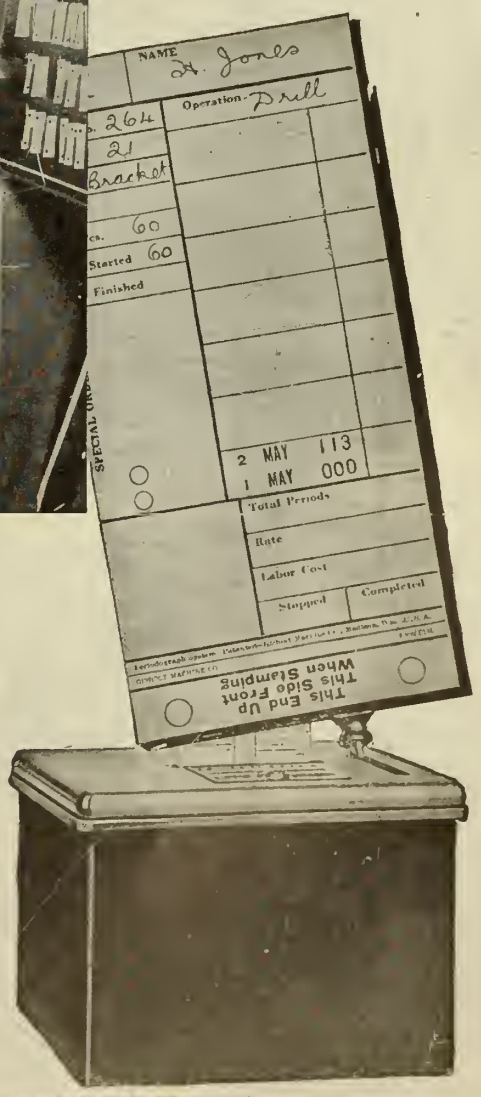
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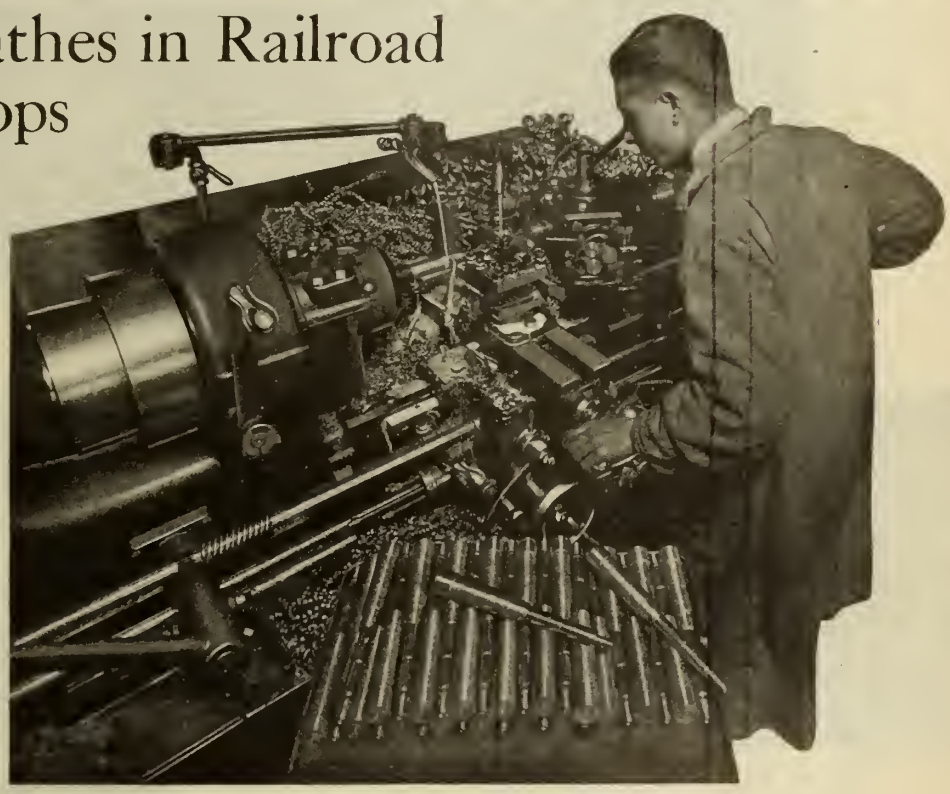
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CANADIAN MACHINERY
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MANUFACTURING NEWS

VOL. XXIV. No. 21 November 18, 1920

Using Turret Lathes in Railroad Shops



The well-managed railroad machine shop has found the value of turret lathes. Their wide range of standard tooling, together with their ease of setting up, makes them a very profitable proposition. Many shops have found it an advantage to concentrate on the making of standardized parts in one shop.

By J. H. MOORE

THE real mechanic of to-day is the man who refuses to sit back and say, "Oh, our present method is good enough." The man who gets ahead is the one that is always on a hunt for a still better method of producing his work. For some time past we have been presenting through our columns different styles of work accomplished on varied classes of machine tools. Not one of these articles has been published with an idea of comparison in mind, but rather with a desire to place before readers how the various firms are producing their products. They themselves can form their own conclusions. By carefully studying these various tool layouts valuable information can be procured which will stand you in good stead on some later occasion when similar problems present themselves.

There is an old saying that it pays to keep posted on all conditions from the foundry to the finished piece, and if more mechanics followed out this advice, production in many lines would soar in consequence. You cannot learn too much about your work, and it is only by studying it carefully that you can master it.

Anyone will, I feel sure, concede the point that the study of motions is a very essential one. There was a time when such an idea was ridiculed, but that time has passed. Henry Ford would never have achieved his present success had not lost motion been reduced to a minimum. Every movement counts if you desire maximum production. Granting that such is the case, how much more so is this true if lost motion is caused through lack of judgment in tool arrangement.

You could take the finest machine tool existent, and mar its possibilities by poor arrangement of tooling. To obtain the best from any machine you must first study your product. Think carefully on what you consider the most economical method of producing such a product, then, having decided on the operations you wish to perform, cast your eyes around and discover the type of machine you require. Manufacturers are rather lucky in these modern days, inasmuch as the makers of various machine tools will, upon request, study their product for them, giving them drawings showing what they believe the best method of producing the same. They even go so far in some cases as to guarantee a certain production, quote both price of machine and tools, or in other words practically solve the production problem for them.

Such service was impossible in the old days, and when a manufacturer can in this way secure such valuable help, it makes his task a much simpler one. All he need do is study the various plans submitted, modify his first ideas if necessary, then choose the equipment he thinks best suited for his own particular requirements.

We will suppose, however, that all this has transpired, that the machines are installed, and the work is being completed as per the submitted plan. Does this mean that the plan is above improvement? Unfortunately such a belief does exist in some plants, but luckily in the majority of shops they are always on the lookout for a shorter method. Improvements to the arrange-



FIG. 1—TURNING A SHAFT. NOTE THE HEAVY CUTS TAKEN BY BOTH TURRETS SIMULTANEOUSLY.

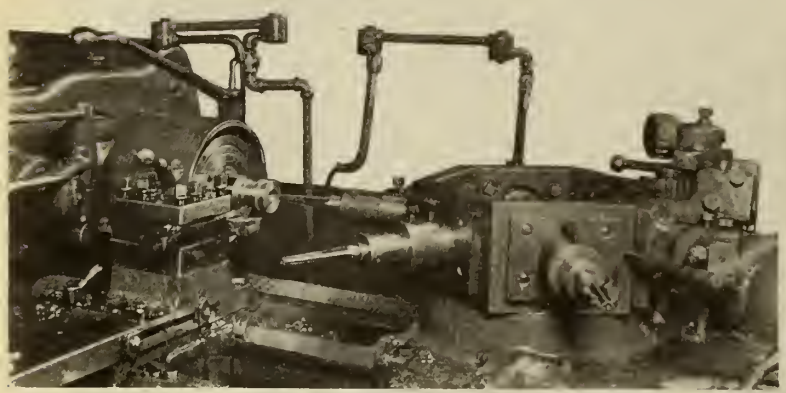


FIG. 4—A PROSSER BEING MADE FROM THE BAR.

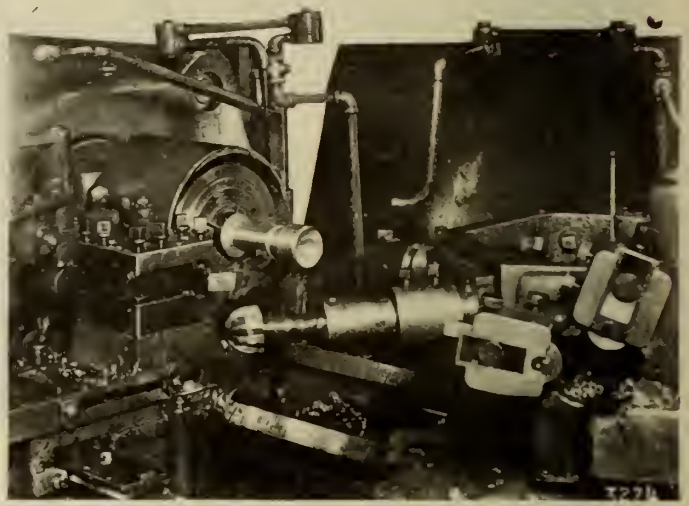


FIG. 3—MAKING RIVET SETS ON THE TURRET LATHE.

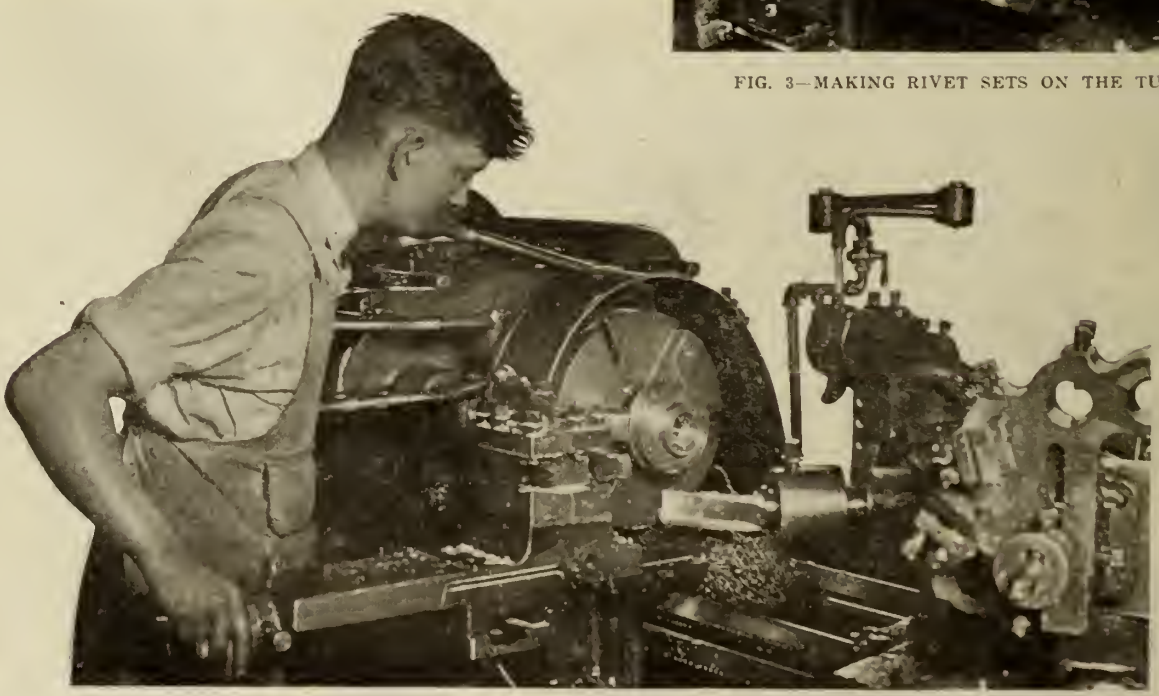


FIG. 2—FINISHING A GEAR BLANK ON THE TURRET LATHE.

ment of the tooling, and sometimes to the design of the tools, add still a better production record. It is this spirit of eager striving after maximum results that is to be commended. We can well afford to have more of this spirit existent.

One of the finest methods of learning is by a study of the other fellow's method, not in a spirit of critical comparison, but actually in a spirit of seeking for further knowledge. This is why we have been presenting the previous articles dealing with tool layout work, and the present material will be followed up later with an account of other methods of producing work on turret lathes. The practice to follow will be that of some examples of work performed on Warner & Swasey turret lathes, in railroad shops. Although these examples are of work in railroad shops, there are many good points to be obtained from them for use in other classes of manufacture.

Examples of Work Performed

The classes of work going through a good sized railroad shop almost defy description, so that we will be able to give but a few of the great many. At Fig. 1 is seen a typical example of shaft turning on a No. 3A machine. Note the heavy cuts being taken by both turrets simultaneously. As this is a straight turning proposition we will pass on to a further example. Fig. 2 represents a gear blank, being finished on a 2A machine. The tooling used is clearly shown and this photograph is shown more to illustrate the variety of work passing

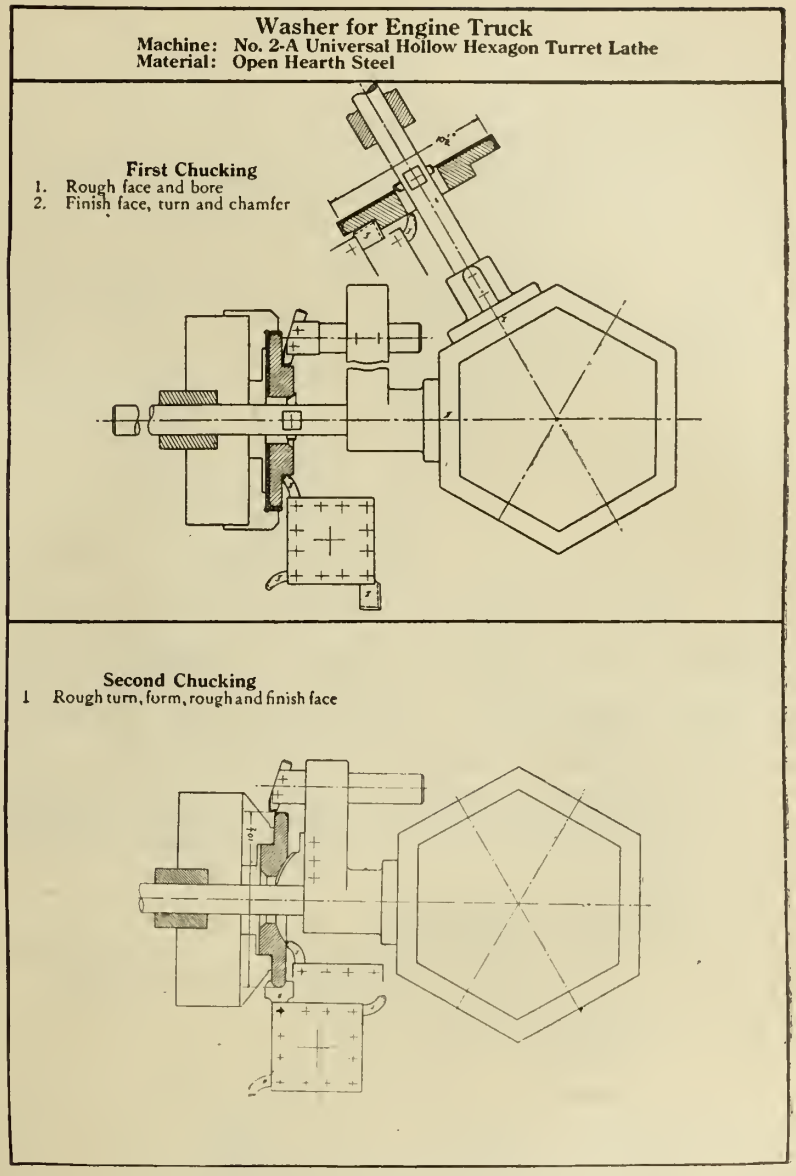


FIG. 8—ILLUSTRATING THE TWO CHUCKINGS ON A WASHER FOR ENGINE TRUCK.

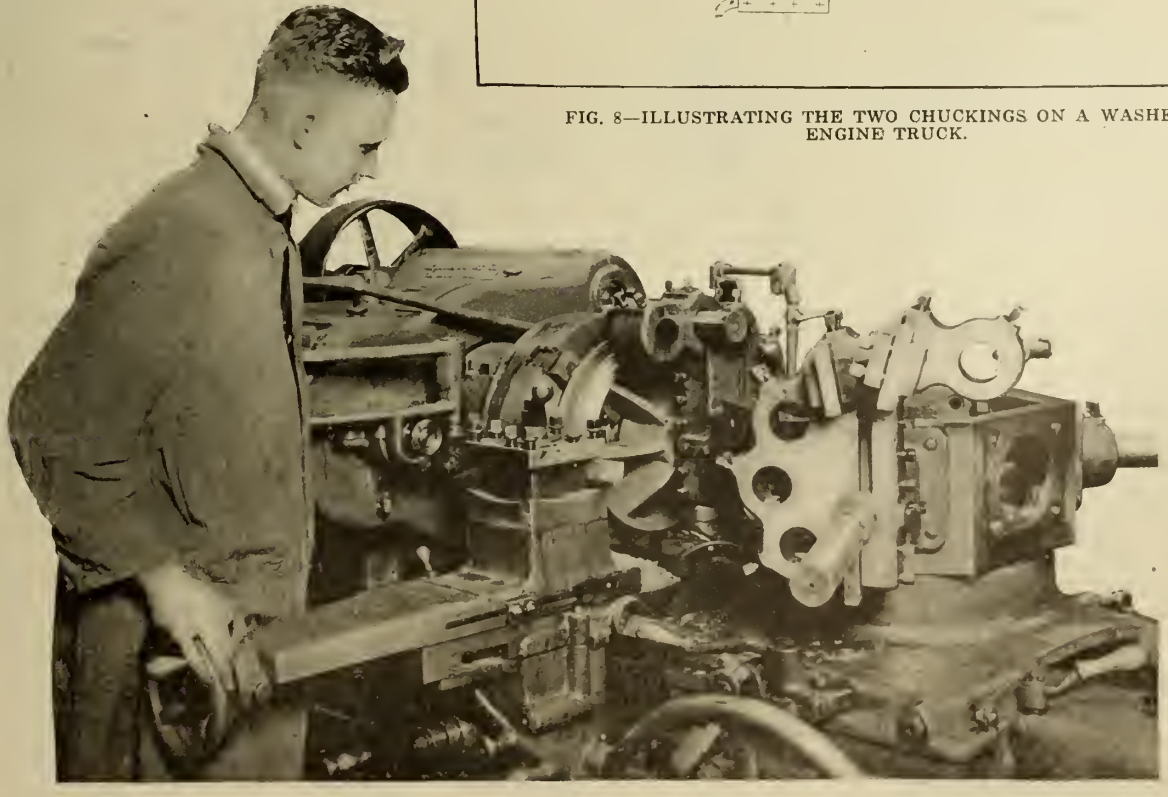


FIG. 6—A PISTON VALVE FOLLOWER COMPLETED IN ONE CHUCKING.

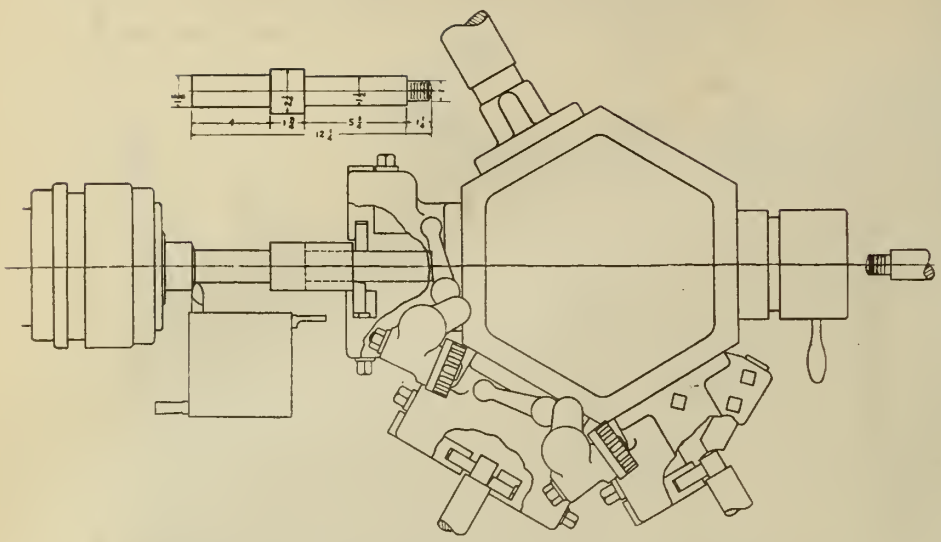


FIG. 7—THIS VIEW SHOWS LAYOUT FOR PINION.

through a railroad shop than for any other reason.

In some railroad shops universal hollow hexagon turret lathes are used to make rivet sets, and one such example is shown at Fig. 3. The work and tools can be clearly seen and require no comment. A prosser being made from the bar is shown at Fig. 4.

The photograph making up the heading of this article depicts a No. 4 universal screw machine busily engaged turning a stud. Both turrets are used simultaneously, and the nature of the work being accomplished can be seen from the pile of studs on the stand alongside of the machine.

Piston Valve Follower

The next example, Fig. 6, illustrates the turning of a piston valve follower in one chucking. To still further discuss this layout in detail, let us refer to the lower part of Fig. 7. Here we see the details of tooling and sequence of operations. The machine used is a No. 3A universal hollow hexagon turret lathe, and the follower is made from cast iron.

At the first station, the work is rough turned to 12⅛-in. diameter, bored 2¼-in., and the piece faced on its 3⅜ diameter surface. At the same time the square turret rough faces the 12⅛-in. and 13 7-16.-in. diameter, and also forms the radius on the 13 7-16-in. diameter.

At the second position the work is finish turned to 12⅛-in. diameter, the 2¼-in. hole is completed, and the 12⅛-in. and 3⅜-in. diameters finish faced. The third station finish faces the 13 7-16-in. diameter portion. The fourth, and last, position used, reams out the 2¼-in. hole.

Further Examples

Let us next consider the first portion of Fig. 7. In this case we have a 2½-in. cold rolled steel pinion, the dimensions of which are plainly seen on sketch. Five stations are used in this case, the sequence of operations being as follows: The stock is fed to length and the 1½-in. diameter portion turned for 6½-in. in length. It is now formed ½-in. to the 1⅝-in. diameter, and turned to 1⅜-in. with the square turret.

In the second position (see view on the other page) it is turned 1-in. diameter for the distance of 1¼-in. length, as shown. The third station forms end, the fourth threads the 1-in. diameter portion, and at the fifth position the stock is cut off.

Fig. 8 depicts two chuckings of a washer for an engine truck. The material is open hearth steel, and the sequence of operations follows: At first chucking the first station rough faces and bores out the work, while the second position is used to finish face, turn and chamfer.

The second chucking rough turns, forms, and rough and finish faces. As the dimensions of the piece are given on the sketch, readers can readily form their other proportions.

Two chuckings are also necessary for the centre ring for piston valve shown at Fig. 9. The machine used is a No. 3 universal hollow hexagon lathe, and the material is cast iron. At the first chucking, the initial station is used for rough turning and facing the work. The second station and the last used in this

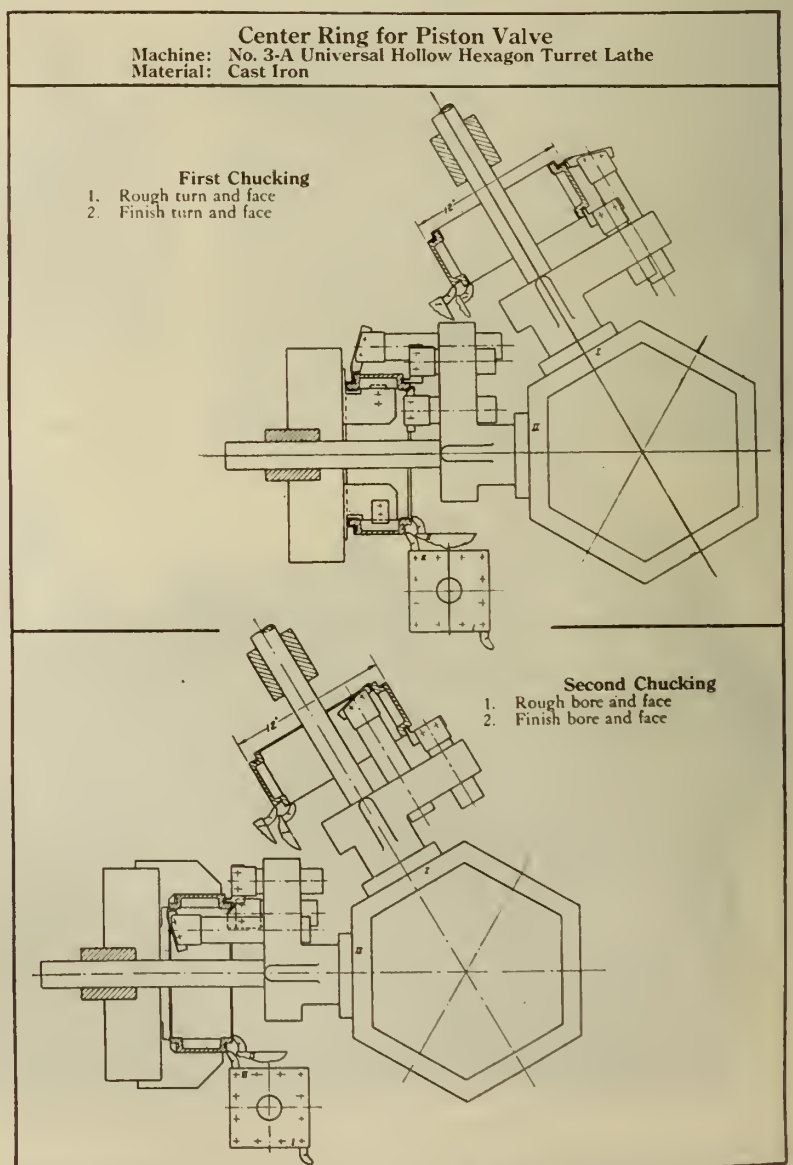


FIG. 9—SHOWING THE TOOL LAYOUT FOR CENTRE RING FOR PISTON VALVE.

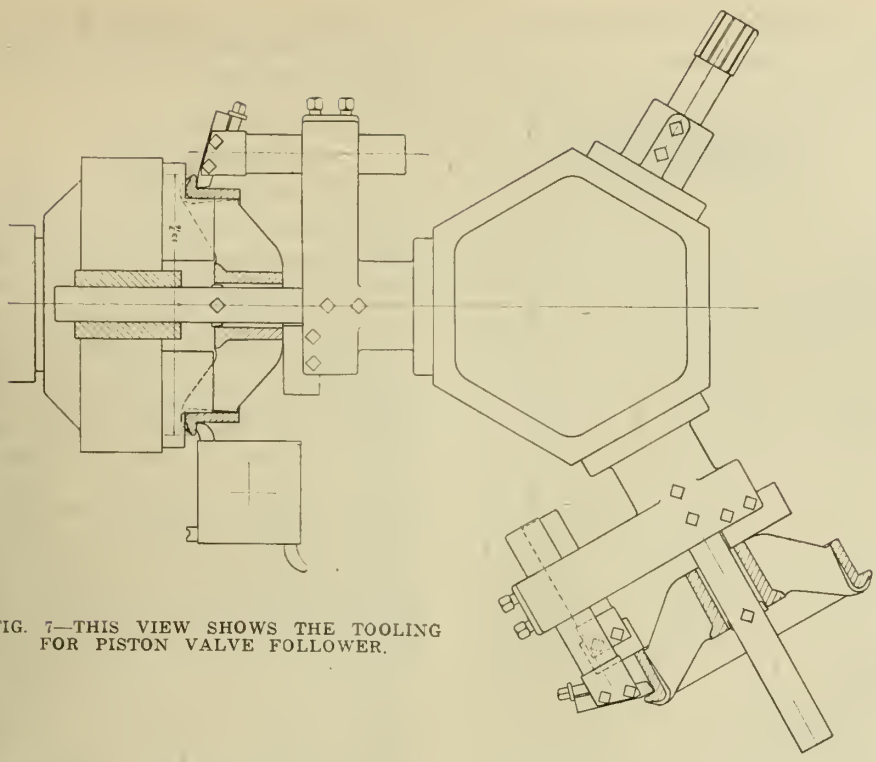


FIG. 7—THIS VIEW SHOWS THE TOOLING FOR PISTON VALVE FOLLOWER.

first chucking, finish turns and faces the work.

The second chucking is clearly noted on the sketch. First the work is rough bored and faced at the portion now turned toward the tools, and in the second position the finish boring and facing is accomplished.

Fig. 10 presents another tool layout of interest. In this case the work is made of open hearth steel and is known as a friction joint for a locomotive trailer truck equalizer. At the first chucking the work is spot centred. The second position rough turns and faces, while the third finish turns and faces the work, aided by the square turret.

The second chucking is shown at bottom portion of sketch. First the work is rough turned and chamfered, then, at position No. 2 it is finish turned. The dimensions of outside diameter of the piece being given, we need state no further as to its other proportions.

The last example, that of Fig. 11, depicts the operations on a certain type of bushing. In this case the machine used is a No. 2 universal hollow hexagon turret lathe, and the bushing is made from a forging.

At the first chucking the operations are as follows. First the six-inch diameter hole is rough bored, and the work is rough faced and turned on its eight-inch diameter. Next the hole is finish bored to six inches and finish faced and turned to its eight-inches diameter.

At the second chucking, the work is, of course, reversed, and the first station rough turns the 8¼-in. diameter, also rough faces. The second position, incidentally the last, finish turns the 8¼-in. diameter, and finish faces and forms the radius in the 6-in. hole.

As stated previously, we are only able to portray a few of the problems possible of solution on this type of lathe. We have in our files, gear blank layouts, friction clutch core work, pulley work, valve bodies, pinion sleeves, pump bodies, differential cases, separator cores, flywheels, and other innumerable examples of work performed. Enough has been shown, however, to illustrate our intentions, and as a concluding remark we might add that, even after you have installed any type of machine, remember to study your tool layout. Keep the layout up to date, and above all do not neglect your tools. Keep them sharp, in good condition, and free from dirt and grease as much as possible.

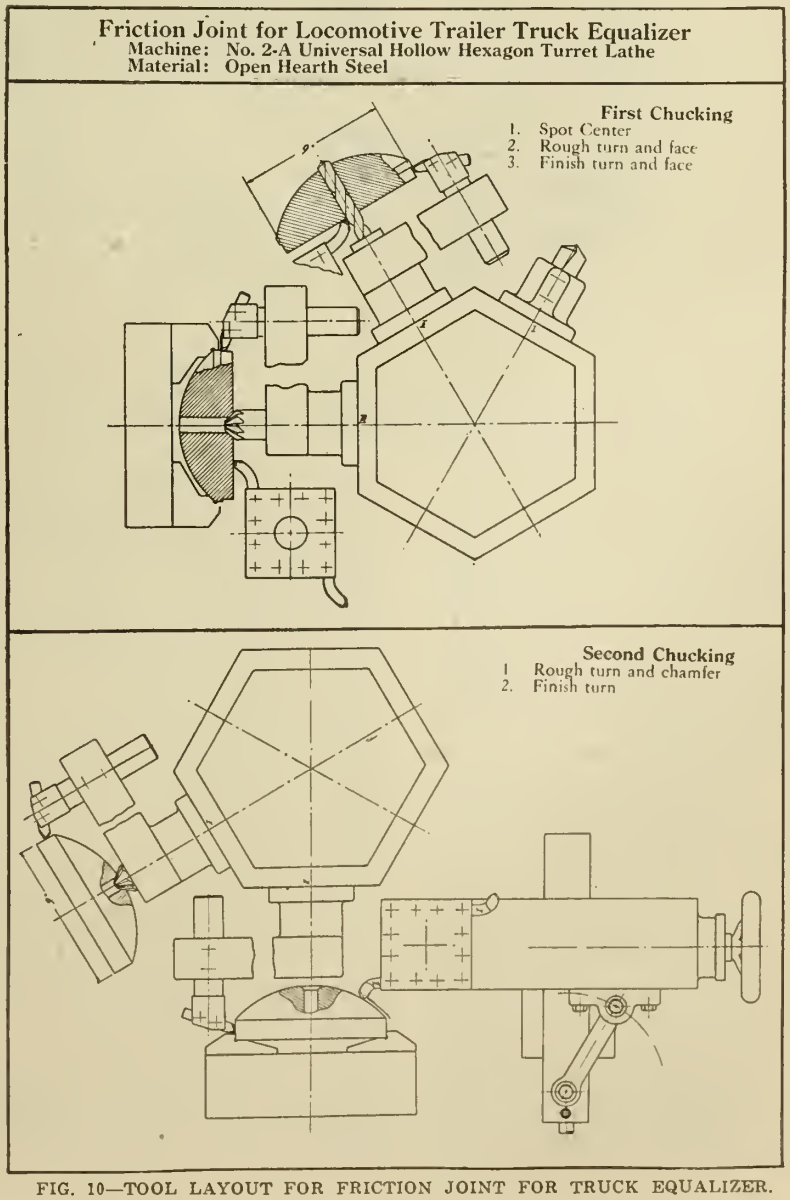


FIG. 10—TOOL LAYOUT FOR FRICTION JOINT FOR TRUCK EQUALIZER.

TINNING BLACK IRON SHEETS AND CASTINGS

By W. S. Standiford

In repairing of automobile radiators and for general use in machine shops in emergency work where it is desired to give black iron sheets and objects made out of bar iron or malleable castings a coating of tin, it will be found that by using the process given below any iron or steel object can be given a thick coat-

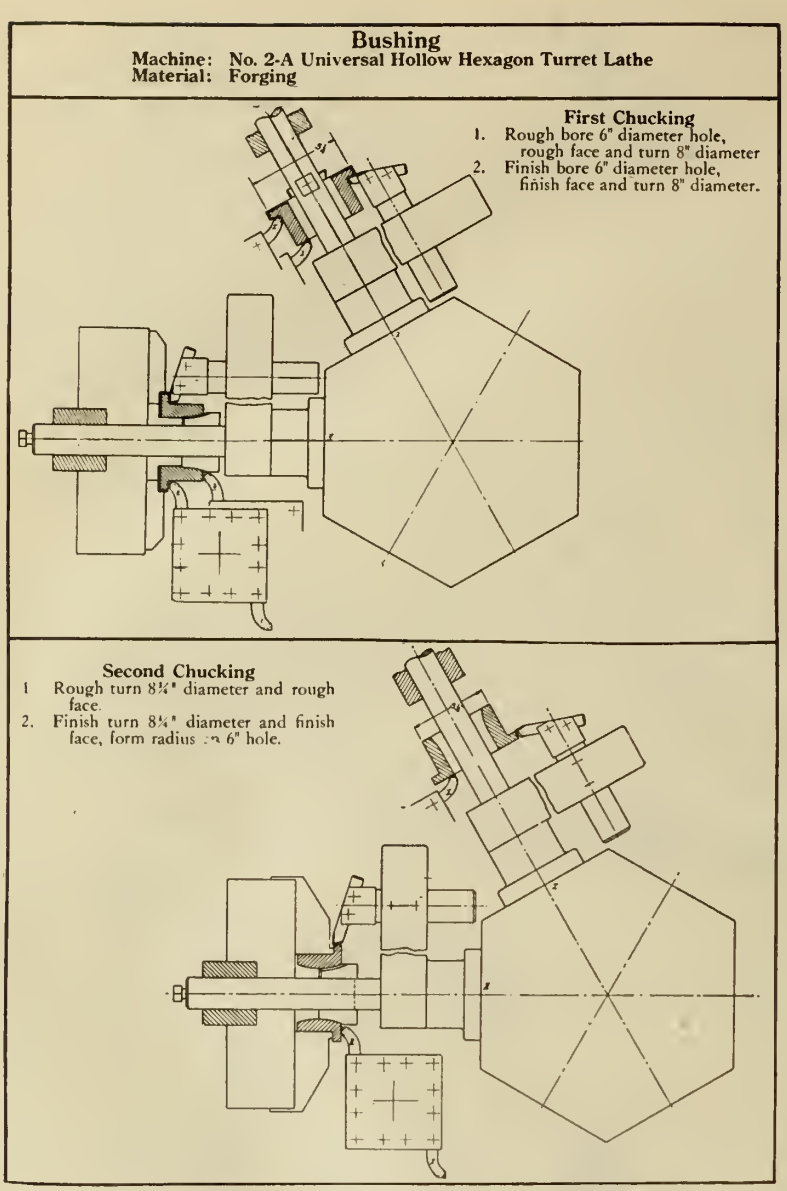


FIG. 11—TOOLING NECESSARY TO MACHINE BUSHING.

ing of tin which will protect it from rusting in exposed places for a long time, as a good deposit of metal can be obtained by this method. All the equipment needed is two crocks of suitable size to hold the raw and cut commercial muriatic acids and also an iron ladle to hold the melted tin. The cut acid should be first made by putting small clippings of sheet zinc into the raw muriatic acid until it will dissolve no more. For use it should be diluted with twice the amount of water. In some cases, it is better to use the cut acid without dilution as some muriatic acids seem stronger than others and work quicker.

All objects to be tinned should have the scale and grease removed from their surfaces. This is best done by wiping them with a clean piece of waste and immersing in the raw acid until all scale has disappeared, and the iron turns white. The time of pickling depends upon the strength of the acid and amount of scale. If much pickling is done, the acid will work slower, but it can be used until it is pretty weak and then thrown away and fresh material used. This process allows of coating iron sheets and other articles with not only solder, but with block tin and also lead, if preferred.

After the objects have had their scale removed by immersion in the raw acid, put them into the cut acid for a few moments and shake the surplus off before dipping into the molten tin or solder. This insertion should be done carefully in order to prevent splashing of the hot metal. If the coating is not satisfactory on the first trial, dip article again into the cut acid and put into the hot metal.

The chemical action of the cut acid is this, that the muriatic acid unites with iron or steel, and in so doing leaves a thin deposit of zinc film which facilitates the adherence of the molten metal to iron or steel objects, causing it to stick better than if the ordinary raw acid were used alone. Many shops accumulate small pieces of solder and these can be used for work of this kind, so that the expense is trivial. Even the dross that is skimmed from a ladle of hot solder can be used for this purpose, if there is enough of it, as there is always a certain amount of pure metal in it to do the work.

RUST REMOVER

A new preparation known as "Meno" rust remover and cleanser has recently made its appearance on the market. The inventor of the preparation is a chemist of wide experience, who, realizing that the present methods of removing rust, corrosion, etc., from machines, engines, tools, parts and all metal surfaces requires considerable time, and high labor costs, commenced the task of devising a better and more economical cleansing method. Here is what he claims for it. This preparation is a scientific combination and blending of certain chemical ingredients, which in combination produce an electro-chemical action that rapidly loosens and dissolves rust, corrosion, grease, oil, dirt, carbon, paint or any other foreign substance that is adhering to the metal—irrespective of its age or hardness—and its action automatically ceases when contact between the cleanser and the metal is established. This is as far as it will go, for it will not injure or mar the surface of the metal itself in any way. There are two methods of using the preparation as follows: (1) Apply it to the machine or part with a brush and allow it to remain for a short time, then brush or rub it off and it leaves the metal bright and clean. (2) Mix the preparation in a vat, tank or container with water, then attach the machine or parts to wire or chain so that they will hang in the solution. No further attention is required since the process of cleaning goes on while the parts are immersed. It is stated that the preparation is absolutely safe in every way and that it will not burn or explode. Another point is that it will not cause corrosion or rust to form, in fact, it protects the metal and makes it exempt from corrosive or disintegrating action for a long period after it has been treated by this preparation, and there need be no fear of injury to the most delicate part no matter what metal it is composed of. The preparation is said to be an economical one to use as the same solution may be used many times over, and does not deteriorate or lose its cleansing power. Peter A. Frasse & Co., of 417 Canal Street, New York, are the sole distributors, and are now establishing agencies in various parts of the country.

SCREWDRIVER ATTACHMENTS

Several types of screwdriver attachments for use on air-operated and electric-operated tools, are now being made by the Independent Pneumatic Tool Company of Chicago. The attachments are made in three sizes to fit the different tools manufactured by the company.

Invention is Important Factor to Community

We All Have, More or Less, That Desire to Invent Something, But Even After the Invention is Completed, Certain Procedure Must Be Followed to Ensure Protection.

By W. McFEAT, Patent Attorney, Montreal.

SOME interesting points relating to patents were brought to light in a recent paper presented by the above author at the Canadian Railroad Club in Montreal, and these facts are of importance enough to warrant their reappearance. After all is said and done, we are all inventors at heart, and for this reason the data will be all the more welcome.

I will first tell, says Mr. McFeat, of whence come our laws by virtue of which these patents are granted. I will also try to give my idea of what an important thing for the community invention is. And I will tell upon what conditions Canadian patents of invention may be obtained and maintained. Also how to realize on an invention.

As early as Edward III, in the year 1477, special acts were passed giving relief against monopolies in the form of Letters Patent, under which great restraint of trade was practised for the benefit of the patentee and the Crown. Our old friend, Sir William Blackstone, in his commentaries, first made in a course of lectures at Oxford in 1753, states briefly the condition of affairs before the reign of King James the First of England (1603). Blackstone informs us that during these early years monopolies were granted by the king for the sole buying and selling, making, working or using, of all things whatsoever, and by these Letters Patent manufacturers were restrained from doing that which they had done before. These monopolies had been increased enormously during the reign of Queen Elizabeth. The penalties provided in these early days consisted of heavy fines, with or without the pillory, and for repeating the offense the loss of one ear. We can imagine some of these early infringers sitting in the stocks for days with their ankles locked in the boards and their hands tied behind their backs, where they were made to suffer all manner of indignities by the loafers in the neighborhood. The practice was at the time to raise large sums of money for the use of the Crown and the Government by means of these patents without the slightest advantage to the general public. Amongst the monopolies granted by Letters Patent was the patent granted to the cloth makers of Ipswich, and the patent for playing cards. In neither of which cases was there any pretence of invention.

Up to this time patents had been granted for inventions, besides many more granted, as I have said, for carrying on certain trades or producing various articles or, in fact, importing them from other countries. The monopolies granted under the Tudor Sovereigns became so monstrously oppressive that the Parliament of England prevailed upon James the First in 1621 to consent to a bill which is the celebrated Statute of Monopolies. This Statute of Monopolies of England is the foundation of all modern patent laws. This original law provides for the grant of a monopoly as a reward not only for the benefit that the invention confers upon the public but also for the ingenuity of the first inventor. Consequently if he who first obtained the patent was not the man whose ingenuity first discovered the invention and if proof existed that it could have been taken from a book or other publication, then, although he may have been the first to bring it to the attention of the public and thereby benefit the public by it, he would not be entitled to a monopoly because he was not the first and consequently should not have reward for ingenuity. This was the belief of the progressive branch of the manufacturers of the early part of the seventeenth century as laid down by this initial patent law, and as I have just said, it has formed the basis of all modern patent laws.

> Modern patent laws of different countries vary considerably. Each country aims to obtain the best results for the community. Read how our Canadian law is enacted.

In order to obtain the monopoly granted by Letters Patent of invention it is necessary for a man to rise above the commonplace in whatever art he may be engaged, whether the building of cars, the construction and laying down of track work, the erection of bridges or the manufacture of steel and other metal parts and textile and wooden things, each contributing to the railway and its operation. He must perceive the obstacles to increased or improved production, or greater comfort for the public or the worker, propound the problem the obstacle offers and conceive a remedy. In this way he rises above the commonplace and by seeking a monopoly in the form of a patent upon the device or process conceived he brings himself in a measure before the public and if he is diligent in promoting the result of his ingenuity he will attract the notice of others working in the same art or those who are financially behind this work. From my years of activity in connection with patents of invention I have come to look upon invention as the dramatic, as compared to the commonplace, in the development of the arts. It is this which to my mind directs that attention to the fortunate one today whose activity makes the first step forward in any art, which brings to him the reward intended by that old law, defined in the Statute of Monopolies back in the early part of the seventeenth century. The dramatic is present in almost all cases where attention is attracted. Take for instance the destruction of lives and buildings in the recent explosion in New York. Our attention was directed to the death of these men and women and the destructon of parts of the buildings, and we all think and talk about it; while just as many lives, just as valuable, are lost, and just as much damage to property takes place each week in the ordinary course of events by street accidents and fires in New York, but they are the commonplace; whereas the explosion was the dramatic. It was the same in the bombing of the City of London by German flying machines when lives were destroyed but not in any greater number than are destroyed in almost an equally short time by street accidents. I wish to impress upon you who are engaged in production that by making a first step forward you are entitled to the notice of those upon whom you depend for advances, and this because of the dramatic nature of the development as compared with the commonplace work.

I have endeavored to bring to you an appreciation of the field that is open to all producers and, I may say, is open particularly to those whose work is the production of that which is necessary to maintain and develop the means of rapid transit.

Patent Laws Vary

The modern patent laws of different countries differ very considerably in their application of the broad principles I have stated. Each country makes its laws with regard to patents of invention, to obtain the best results for the community. In some countries limited publication of the invention there or in fact anywhere in the world makes the invention public property if this publication has not been preceded by the application for a patent. Other countries require that the invention be manufactured to a reasonable extent in that country in proportion to its manufacture abroad. Other countries ignore these requirements and as in the case of the United States, for instance, permit manufacture and sale of the invention in that country for two years before the patent is applied for. In some countries importation of the patented invention is allowed and the patentee may stop all others from importing while he, under his monopoly, may import and thus supply the demand of those countries. These

foreign laws, or the majority of them, had been in existence for many years before the present Canadian patent law came into existence and apparently our law makers adopted in a single law what appeared to be the features of these other laws which are good for Canada. Being Canadian producers we are, of course, interested principally in the Canadian law. From my point of view it has been necessary to emphasize the importance of looking for and overcoming the obstacles to progress in the arts in order that you may appreciate what a patent of invention is; and what I have said regarding the stepping forward in the art is universal and consequently is essential to the application for letters patent of invention of Canada.

Assuming that a worker in one of the arts has perceived his obstacle and conceived his means for overcoming it and making his forward step, and wishes to obtain the reward to which he is entitled, he is, according to Canadian patent law, permitted to manufacture and sell the invention for one year, wherever he may be, even in the Fiji Islands. If he makes his application for a patent in Canada within that year and is the first to have the ingenuity to make the forward step he is entitled to his patent, provided he can truthfully make oath that his invention has not been in public use or on sale with his consent or allowance for more than one year. He must make this oath in his application. An examination is made in the Patent Office at Ottawa in order to ascertain, if possible, whether he is the first to make the invention and if nothing to the contrary is found the patent is granted. During the time between the filing of the application and the grant of the patent and during the year before the application is filed the inventor may have the invention manufactured wherever he pleases and may import it into Canada without jeopardizing his rights; and he may also continue to import the invention for one year after the patent has been granted. There is provision in the Canadian Act for an extension of this year but the Commissioner of Patents must be satisfied that the further importation after the first year will be for the benefit of the community and that it will lead to manufacture in Canada, otherwise he will not grant any extension. With regard to the manufacture of the invention in Canada—as the patent issues it is subject to a provision of the Patent Act which requires that manufacture of the invention be commenced in Canada within two years after the date of grant of the patent and after such commencement the manufacture must be continuously carried on, even if it has been commenced before the application is filed. Failing commencement to manufacture, and continuously manufacture, the patent is forfeited and all rights and privileges thereby granted cease. The law is very strict in this regard and the Privy Council has stated that there is no room for interpretation, its reading being perfectly clear. There is no doubt about this as the section of the law covering manufacture reads thus:

"Such patent and all the rights and privileges thereby granted shall cease and determine and the patent shall be null and void at the end of two years from the date thereof unless the patentee or his legal representative within that period or an authorized extension thereof commence and after such commencement thereafter continuously carry on in Canada the construction or manufacture of the invention patented, in such a manner that any person desiring to use it may obtain it or cause it to be made for him at a reasonable price, at some manufactory or establishment for making or constructing it in Canada."

Before 1903 it was the common belief amongst manufacturers who took advantage of patents of invention to improve their business that this law could be interpreted to mean that manufacture need not be carried on unless there was a bona fide demand; but in 1903 this section of the law was tried out and our Supreme Court decided that the law was clear and that there was no room for interpretation, this decision being upheld by the Privy Council. The result of this decision was that the owners of a large majority of Canadian patents found that their monopolies had been forfeited, and they got after our law makers and made them pass what is known as the Remedial Act, which revived all the patents forfeited, upon the condition that manufacture should forthwith be commenced. But a difficulty presented itself. How could the inventor of a grain elevator or a railway bridge or a round house commence to manufacture his invention and continuously carry on the manufacture or erection if the Government or the railways could not be made to see sufficient advantage to give an order? This was taken care of in the Remedial Act by providing for relief from the restrictions of the law regarding manufacture, and provision was made for an order to be granted by the Commission relieving such patent from the restrictions of the law and making the owner responsible for the manufacture of the invention in Canada so that the reasonable requirements of the public in reference to the invention would be satisfied. This may be done by granting a license, and any one interested in the art to which the invention appertains may go before the Commissioner, and upon proving to him that the owner of the patent either by neglect or wilfully monopolizing the invention has prevented him from obtaining it, may obtain an order from the Commissioner on the owner of the patent compelling him to grant a license to the sufferer. The owner of the patent, however, may be heard and if he proves that the alleged sufferer is not in the true sense of the word "of the public," but, on the other hand, a competitor of the owner of the patent in the supply of the invention to meet the requirements of the public, then it may be expected that the Commissioner will deny the petition for the license and the alleged sufferer will be compelled to send his customers to the owner of the patent. If, however, it appears to the Commissioner that the owner of the patent is exercising his monopoly in the restraint of trade or is otherwise not satisfying the reasonable requirement of the public in reference to the invention, then he will order the owner of the patent to grant the license; and if the license so ordered is not granted within three months, then the patent will be forfeited. I may draw attention here to the fact that the spirit of Canadian patent law is that manufacture for Canada's need must be carried on in Canada. This is further demonstrated in another condition upon which the Canadian patent is granted, namely: the limit of time set for importation of the invention. According to law if the owner of a patent or his licensee or an assignee of a share in the patent, imports the patented invention or any machine or car or locomotive or frog members, switchstand or anything else containing the invention after the expiration of one year from the grant of the patent, then the patent shall be void as to the interest of the person importing it. For instance, supposing John Jones has a patent on a detail structural part for the reinforcement of the roof of a box car and he grants a license to a car dealer who has the cars built in the United States and equipped with the patented structural detail. These cars are imported by him into Canada say one year and three months after the issue of the Canadian patent and sold to a railway company. In this case the patent is forfeited because of this importation, but it is only forfeited as to the interest of this dealer and consequently his license is lost; and if John Jones has had nothing whatever to do with and no knowledge of this importation, then his patent is not affected. On the other hand, if John Jones has knowledge of this transaction of his licensee, which may be proved by the obtaining of license fees for the cars sold, then he has connived and because of this connivance, not having prevented the licensee from importing, John Jones also forfeits his rights and the patent itself becomes null and void and the invention is thereby free to be used by the general public. There is an erroneous belief that the Canadian patent law does not apply to railway inventions and that cars and locomotives and railway stock generally may be built or equipped in the United States according to or with inventions patented in Canada and imported into Canada without jeopardizing the Canadian patent rights. In fact, I have heard it stated positively by lawyers in the United States that the Canadian Patent Act makes an excep-

tion of railway cars. They base their contention on a section of the Canadian Act which makes an exception of inventions in any foreign ship or vessel touching our shores. The law, however, is not any more open to interpretation than the law governing manufacture, because its wording is simple and very clear. This interesting law reads as follows:

"No patent shall extend to prevent the use of any invention in any foreign ship or vessel, if such invention is not so used for the manufacture of any goods to be vended within or exported from Canada."

There is nothing equivocal in these words. It is clear that the law relates to any foreign ship or vessel and it does not require a legal luminary to make our learned judges understand what is meant by the words "foreign ship or vessel." Anyone having a rudimentary knowledge of the English language knows that a foreign ship or vessel cannot be a railroad car on rails and I have no doubt that when the time comes for a court of competent jurisdiction to decide what this law means that there will be no hesitation in deciding that it has reference to ships or vessels or in other words steam ships or sailing vessels coming from foreign ports to the ports of Canada, and that it is limited strictly to these ships or vessels and cannot be extended in its scope to include railway rolling stock. There is considerable controversy about this, but our friends across the border who persist in ignoring our laws governing manufacture and importation cannot have a conviction of the justice of their cause, when they argue that the railway rolling stock is a foreign ship or vessel, otherwise they would take the steps available to obtain a decision on the question by our courts.

Interesting Phase

Another phase of the Canadian patent law which I should bring to your attention is the fact, not before mentioned, that an applicant must swear that his invention has not been in public use or on sale for more than one year with his knowledge or consent, before his application for Canadian patent. When the invention is conceived and developed in Canada it is not likely that the inventor will sacrifice his rights. The case is different with the inventor who conceives and develops his invention in the United States, because if he takes advantage of the United States law and puts the invention on the market for almost two years before he applies for his United States patent, then he will have forfeited his Canadian rights even before he applies for his United States patent. In many cases this is done inadvertently, the United States inventor being ignorant of the Canadian law, and after his United States patent application has been allowed and he finds his invention is a money-maker in the United States he turns his eyes to Canada and seeks advice from his attorney regarding Canadian patent rights. The grant of a Canadian patent is also subject to the filing of the application within one year from the date of the issue of the first foreign patent for the same invention. It has happened in cases which have come before me for investigation that the United States inventor has not filed his Canadian application until sometimes five or six years after the first public use or offer for sale of the invention in the United States. This comes about in this way, he makes his forward step in the art and in order to ascertain if the idea is practical and if practical whether there is any money in it he gets some made and places them on the market, or if it is a comparatively large plant interests a railway or other large corporation by offering the invention by means of blue prints. A bridge, of course, could not be built and then offered for sale, so the inventor would bring his drawings to the bridge department of the railroad and submit his idea. Whether the bridge is built at that time or not the inventor must file his application for a Canadian patent within twelve months from the date he offers it for sale. If he does not offer it for sale but constructs the invention in private and then puts it in use where it may be seen by the public, a new headlight for instance, he must file his application for a Canadian patent within twelve months from the day of first public use. Our friend, however, usually has no knowledge of this condition of grant of the Canadian patent and may have been told, as has too frequently happened to my knowledge, that the Canadian patent may be obtained by filing an application within twelve months after the issue of the corresponding United States patent. With this idea in the United States inventor's mind he proceeds with his United States work and after having satisfied himself that the idea is practical and a money-maker, he files application for United States patent. It is a well known fact that an application for United States patent takes all the way from six months to six years and longer to get through the Patent Office. Assuming that this inventor's patent issues in the United States two years from the date of its filing and it is filed one year and eleven months after his first offer for sale or public use after the issue of his United States patent and within a year he files his application for a Canadian patent, ignoring the statement in the petition that the invention has not been in public use or on sale with his consent or allowance for more than one year previous to his application for a patent in Canada, then his application is void as is also his patent if granted. Sometimes these inventors have been advised that what is meant by this statement is public use or offer for sale in Canada only, and that public use or offer for sale outside of Canada does not affect in any way the Canadian rights. This is not so. The Canadian application must be filed within one year from whichever is the earliest date, the offer for sale, public use or issue of the foreign patent. For this reason a large proportion of the inventions which have been conceived and developed in the United States and form the subject of Canadian patents have been dedicated to the public of Canada before the filing of the application for the Canadian patent and consequently, all these Canadian papers are not worth the paper on which they are written.

Contrary to common belief, invention is a simple process of the mind and it may be interesting for me to give some examples:

It was found that in casting metal rotary motion would result in throwing out the dross. This was due to an understood law of nature, an operation of centrifugal force, the advantage being that, for instance, rollers with more perfect surfaces could be cast. This was known and it was the practice to stir or otherwise cause the metal to rotate, it being an understood law of nature that rotary motion would so result, as an operation of centrifugal force. The point I wish to convey is that those skilled in the art of casting metal knew that by imparting a rotary motion to the molten metal, the dross would be caused to separate; and the problem before all molders was to produce the motion more conveniently and uniformly than by stirring the liquid metal, as soup would be stirred by a spoon in a pot. The commonplace workers in the art employed any kind of implement suitable for the purpose and overlooked the inconvenience and want of uniformity, but a man named James Harley, a workman in a foundry in Pittsburgh, conceived the idea in 1834 that he could make the metal revolve by injecting it into a mould tangentially. He obtained a patent for it and the patent was upheld. Another interesting simple invention was made by Asa Whitney, of Philadelphia, in 1848. He discovered that hardness once given to iron will not be destroyed or seriously impaired by the immediate reheating of the iron and its subsequent very slow cooling. What he discovered was simply a law of nature and as such could not be patented, but he went further and worked out a process consisting in taking the wheels from the moulds very soon after their rims were chilled and in putting them immediately into a chamber which had previously been heated about as hot as the heat of the wheels when put into the chamber and thereupon raising the temperature of all parts of the interior of the chamber or furnace and its contents to an equally high point, and finally in causing all parts of the wheel to cool with equal slowness. Mr. Whitney obtained a patent for his process and his patent was upheld. In each of these cases the invention consisted in simply applying a well known law of nature to a certain

art and the simplicity resides in the fact that once the obstacle is seen and the problem is lined up there is usually very little difficulty for the trained mind to conceive an idea by which the obstacle may be overcome and a step forward made in the art.

Another Example

Let us take as an example an invention which has been produced in Montreal and assume that the inventor, contrary to the usual practice of inventors in the Province of Quebec, wishes to obtain a reward for his invention. He makes his application for a patent within one year from first public use, and if he has not already commenced to use his invention he introduces it to the trade. Of course, if he has a backer he may be relieved of the necessity of introducing the invention to the trade by his personal effort, but the case I am taking as an example is one where the inventor has no backing. I have known cases where the inventor has succeeded by first having his invention manufactured, then obtaining a price from the manufacturer, after which he approaches the jobber, the retail dealer or the consumer, turns over any order he obtains to the manufacturer to be filled at a price stipulated in a contract, his sale price being, of course, in advance of this. A demand may be created this way, having for its purpose to induce the manufacturer, jobber, or retailer to become interested. There are many other ways of course to realize on inventions.

There is a great advantage to employers from patents upon inventions developed by their employees. This is so whether the patents are held by the employer or employee, and the advantage is due to the mere fact of the patent being obtained which usually proves a bar to a competitor obtaining a patent by which he may hold up his employer.

With regard to contracts many of our prominent concerns make contracts purporting to be based upon patents of invention but when investigated and analyzed prove to be a guarantee of profit to some outsider which could not be exacted except for the contract itself. Business troubles of this nature can usually be foreseen and avoided by a careful investigation of the antecedents of the patents involved before the contract is signed.

In conclusion I would say that the individual granted a monopoly on an invention by the Patent Laws of Canada is afforded a protection which is not equalled by the patent laws of any other country, and he is encouraged to explain his invention to those engaged in the same kind of work. His patent of invention is a property of which he cannot be despoiled by any Act of Parliament either Federal or Provincial. His right is not excelled in point of dignity by any other property right, and equals the right of authors in their copyrighted works. Furthermore the benefits he confers are greater than those he receives, for he confers upon his community a means of either lessening toil or of increasing comfort. It is also an indestructible heritage of posterity. In return he receives a limited and conditional monopoly from the Dominion of Canada the grant of which costs neither the Government nor the people anything. And his reward shall be all the more sure because it is for creating things unknown before, the creation of which is a step forward in the commercial or scientific life of this country.

HE WANTED A LITTLE TIME TO GATHER MONEY AND GOT IT

IN these days of financing, men are doing things at times because they have to, and not because they want to. Here is a story related to Canadian Machinery to-day as illustrating the effect of tight money on some lines:

"A friend of mine," stated our informant, "had a shipment of parts coming in amounting to about $25,000, and he had secured these on the understanding that it was to be practically a cash deal. The bargain was made some time ago, when it was a great deal easier to finance than it is now. He was in need of the parts to finish up work that he had under way in his factory, but to tell the truth he did not have the $25,000, and there was not one chance in a thousand of the bank helping him to get it, or any portion of the amount. Without the parts the stuff he had in the process of manufacture would be no use at all. So there he was.

He Started Something

"Well, this friend of mine is somewhat of the plunger type, and it is a hard thing to get him stopped entirely. So he wired at once to cancel the order and stop shipment of all goods ordered by him. He knew quite well that the parts made up would be of no value to the firm that had made them for resale, and the chances were they would protest against any such thing as a cancellation, although there was no mention made of such a thing in the sale. The expected happened, and it was not many hours before a wire came back to the effect that the order would not be cancelled. My friend was highly pleased to hear this because he wanted the parts. So there started a letter-writing contest that lasted for some days that ran on into weeks. In the meantime he was busy digging up money. His proposition is all right and safe enough, but that does not seem to make much difference just now when it comes to raising cash. At the end of three weeks he had $18,000 in the bank against the shipment, and in order to save further legal trouble the man who was making the parts agreed to ship on payment of $15,000 and give him thirty days for the balance. Well, that was exactly what he wanted—nothing more than a little time, and he got it and made good use of it.

"I claim," continued our informant, "that my friend's nerve was a good thing for all concerned. It was a good thing for the man who had the goods ready to ship to him, and who was moved to the point of legal action by his threat of cancellation. It was a good thing for the men in those two plants that he did just what he did. It saved the situation, and I know of a good many men who, if they faced such a problem, would simply be licked. It all goes to show that a certain amount of daring—and shall I say nerve as well?—can get people out of trouble as well as into it."

Now on Canadian Market.—The Magic Leather Treatment Co., Detroit, have opened a warehouse in Windsor, Ont., whence they will cover the requirements of the Canadian market, thus eliminating details of exchange and customs duty. This product will thus be placed on the Canadian market for the first time. It is a purely neatsfoot oil proposition. A high viscosity is secured through a scientific chemical process, so that when the treatment (it is not a dressing) is stuffed into the belt it becomes a good substitute for rubber, making the belt impervious to all shop or climatic conditions. It is alike applicable to leather, canvas, and manila rope and, it is claimed, increases the life of the belt four times. It is especially useful for belts in bakeries, dairies, confectionery and other food manufactures, where odorless, sanitary conditions are necessary. Mr. J. Horrocks will have charge of the Windsor office and is the chief selling agent for Canada.

NEW DISAPPEARING WINDOW SHUTTER

Continued from Page 457

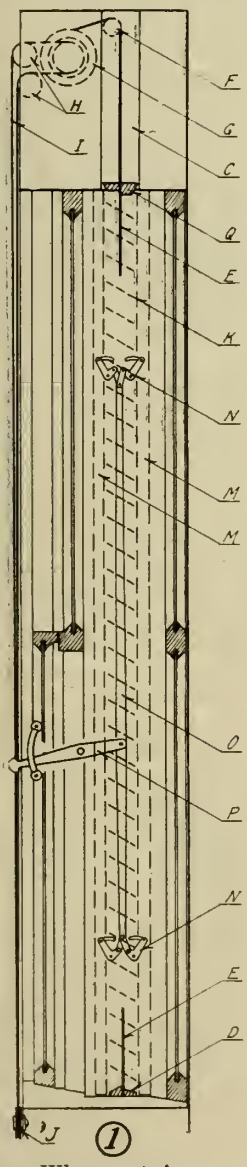
by the bar Q resting on the bevelled portion of the frame.

Fig. 1 is a skeleton view of the window, with shutter lowered and before closing. Fig. 2 is a detail of shutter completely closed and slats K locked by lateral movement of the vertical strips M. Fig. 4 illustrates the mechanism for moving the strips to and from the shutter slats. Two views of the shutter and the elevating supporting bar are shown in Fig. 5. A partial section of the upper chamber is illustrated in Fig. 6, and a general cross section of one side is shown in Fig. 7. Negotiations are now progressing for the formation of a company to manufacture this appliance.

New Design of Disappearing Window Shutter

By J. H. RODGERS

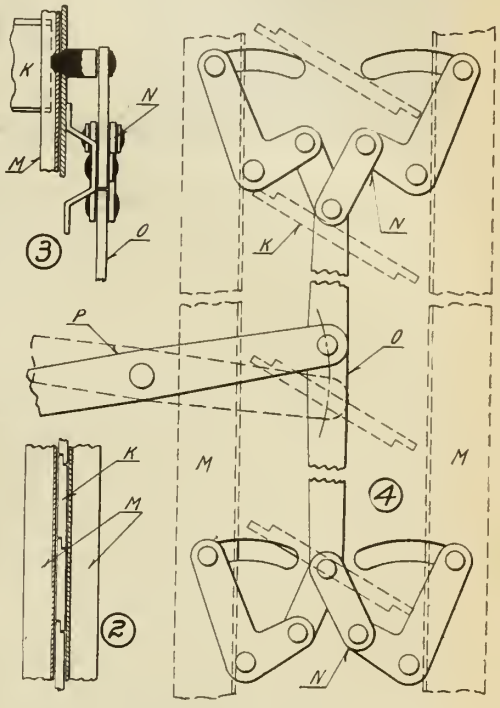
THE accompanying drawings illustrate the general construction features of a new design of window shutter intended for use on office buildings, factories and private residences. This device has been invented by Charles A. Bull, of Montreal. It is claimed that the shutter can be constructed to conform to existing windows, or as is primarily intended, may be incorporated into a window casing, thus forming part of



the whole. When not in use the shutter is elevated by means of cables and located in a chamber attached to the upper framework of the window. When in a closed position the shutters are held firmly closed by the pressure of the side strips bearing against either side and at each end of the shutter.

In the design shown the construction calls for the placing of the shutter within the space between the movable windows and the storm sash. The design may be modified to suit any particular style of casing. Provision has likewise been made for adequate fire protection in the automatic closing of the shutter, consequently eliminating the creation of draft for feeding the flames.

In the sketch shown A represents the sheet steel frame of the window. B is the upper portion in which is the chamber C for retaining the shutters when same are not in use. The lower or elevating bar D is supported by a cable E —one on either side. This cable passes over the pulley F, and is wound upon the spool G. On the same shaft that carries the winding spool is a small drive pulley around which passes the control cable or link chain I, this cable passing over the guide pulleys H and thence in a downward direction in front of the window frame to the pulley J. This pulley is fitted to an adjustable bracket for regulating the tension of the operating cable. The shutter slats K are suspended an equal distance apart and the end trunnions are slightly off-centre so that they automatically tilt into an inclined position when lowered from the upper retaining chamber.

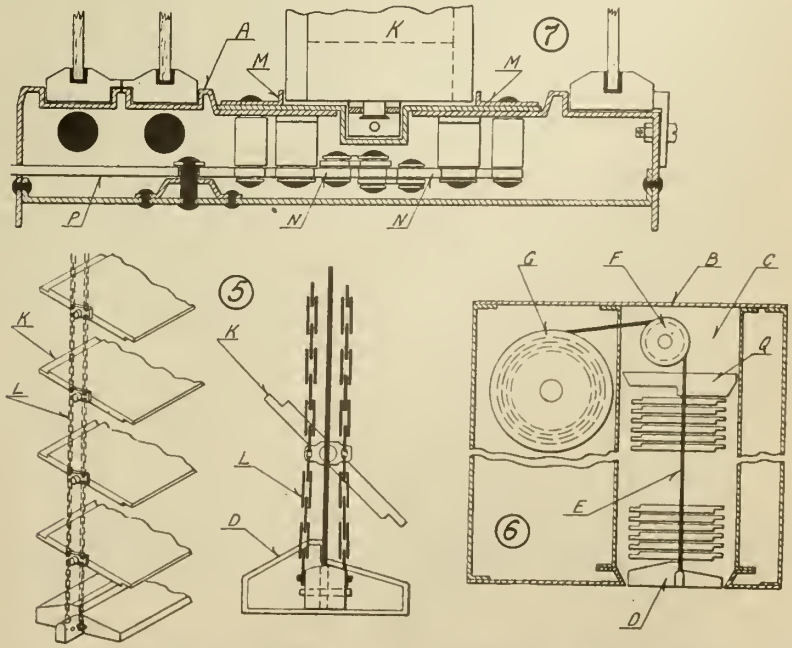


VIEW SHOWS THE ATTACHMENT IN DETAIL.

When completely lowered the piece D rests upon the sill and the vertical locking strips M are pressed against either side by the movement of the link mechanism N, operated by the connecting rod O, which is moved in a vertical direction by means of the lever P, the outer end of this lever protruding through the casing of the window frame and within easy reach of a person in the room.

A ratchet bracket is provided for locking the shutters in a closed position. The edges of the slats are overlapped to exclude the air and light and prevent the passage of rain when storm windows are not in place, or when shutters are located on the extreme outside of the frame. When in a closed position the opening to the upper chamber is blocked

Continued on Page 456



THIS SHOWS VARIOUS DETAILS OF SHUTTER. REFER TO TEXT FOR EXPLANATION.



WELDING AND CUTTING



Lessons of the A.B.C. of Good Welding

This Material Deals With the Ideals of the Welding School

By W. B. PERDUE

SEVERAL years ago the prospective purchaser of a welding torch hung out a shingle with the stereotyped sign "Welding and Brazing" upon it. Many times the shingle was displayed before the torch arrived, so that several jobs might be waiting long before the new welder figured out just where to connect the hose and just how he could connect up all the tips which came with the outfit at one and the same time.

To him the torch and its seemingly intricate regulators were a thing of mystery—he had never seen one before—and you can wager your last nickel that when he once succeeded in getting the regulator pressures adjusted so as to get some definite action that he never moved them. There they stayed until the terrific impact of the full cylinder pressure pounding down on the seat each time the tank was opened rendered the seats useless. Then, of course, the company who sold them came in for a "good hauling over the coals."

Recently, however, much of the injury to the good name of the welding industry has been retrieved by progressive and up-to-the-minute welding concerns who have brought the merits of welding before the public so forcibly that the trade schools throughout the country are devoting more interest to this trade than to many others.

Scientific Interest Justified

When he catalogues the various subjects in which the welder must be versed, or of which at least a working knowledge is required, the college professor or the dean of the engineering school is well justified in giving the art of welding a place in the sunlight. It is gratifying to see this awakening of scientific interest and the great amount of research work that is at present being conducted, and more especially the demand by many of the large users of welding for engineers with sufficient knowledge of the process to determine by visual inspection of a weld whether or not it is sound and has been executed by a skilled operator.

A thorough study of the requirements necessary to secure complete and proper penetration coupled with the ability to properly execute the work oneself will enable the inspector to pass upon welding more rapidly than upon the work of any other skilled mechanic. The fact that the author in addition to his other duties inspects more than one thousand pressure containers per month, and in the event of defective work not only replaces the container but bears all expenses that have been entailed by the purchaser, should convince the skeptic that this work can be done with great rapidity and that the percentage of defects that can escape the trained eye is almost negligible.

The decline of the apprenticeship system of recent years and the demand for skilled workers during the war led many inexperienced laborers to represent themselves as skilled mechanics and to secure employment as machinists, carpenters, toolmakers and what not. The scarcity of labor at that period enabled many of these to hold positions for a few days and thereby to secure some valuable schooling at the hands of the foreman who was compelled to "turn orders out." In many machine shops there were mechanics detailed to set and grind tools for "operatives" who knew nothing more than "stop the machine if something goes wrong."

After drifting from one shop to another, and devoting his leisure to study in the public library it often happened that the "operative" learned enough to enable him to hold down a permanent job. The field of the modern trade school is to save the employer the hundreds of dollars' worth of scrapped material resulting from the work of inexperienced operatives, or in other words, to form a link between capital and labor.

Welders Require Skillful Training

To the uninitiated the art of welding appears simple. The beginner or the helper who has watched his welder for many months is very prone to remark that he has noticed how clumsy others have been in their work and that he is confident that he can master the entire process in a very few days. Others quite as firmly believe that they can master the art by home study and self instruction. We do not wish to go on record as making the statement that such procedure is impossible, but we do state that the cost of any materials required to master the art under such conditions would by far exceed the cost of tuition and expenses in a school of recognized merit where the help of one or more expert instructors is at all times available.

The average student is inclined to be over-anxious to get to the point where torch manipulation and practice is no longer necessary. The man who cannot execute a bronze weld with a ripple of absolute regularity and cannot continue to move his torch hand without interruption while his left carries the welding rod after more flux needs more practice. Welding looks simple, but appearances often deceive. It cannot be learned in a short time by the average man who is readily discouraged. After the third or fourth unsuccessful attempt to execute a neat ripple he is very likely to give up.

This is fortunate rather than unfortunate. Men who are so readily put aside would not become an ornament to the profession. They would not have the patience to carefully study what others are doing or attempting to do, and to keep themselves abreast the times through the medium of their trade journals. On this particular subject a well-known authority on training welders states: "It is essential that he (the student) should familiarize himself with the physical and chemical laws embraced in the welding and cutting business." Such knowledge will instil great respect for the powers that he controls and afford the necessary resourcefulness to overcome difficulties that may be encountered. The more knowledge he has at his command the greater will be his respect for his trade and his desire to assist in its upbuilding.

An ignorant workman becomes a mere machine, able to turn out sound welds only under such conditions as have been taught him by others. The calloused villain of the movie screen who is made to

---

AUTHOR'S NOTE.—The increasing number of inquiries from high schools and trade schools which teach welding, as well as large concerns who are unable to secure competent help and must therefore train their own men, necessitates a more detailed reply than can be given in an ordinary letter. Hence this article. The regular routine of instruction will be resumed next issue. The principles given are not all original with the author, but are such as have been found most successful in welding schools throughout the entire country.

exclaim, "—— them, they are nothing more to me than machines," may have been nearer to the truth than we like to imagine. Yet we have the consolation that it depends entirely upon the mechanic himself whether he does the work and receives the pay of a "machine" or uses his thinking powers to lift himself into the class of the thinkers and doers.

The more highly trained and intelligent workman may be no better welder on common every-day routine and repetition work, but his broader knowledge of the principles on which his trade is founded will make him more resourceful and consequently better able to cope with new problems and to handle high-class work that may be a little out of the ordinary. Hence, the welding school must not stop with the manual training of the welder and such lectures and lessons as will enable him to gain a general notion of the physical and chemical laws which govern his work, but there should be a decided effort to train each individual student to think for himself.

Honesty Above All Things Else

The first thought to a student of any trade school should be the necessity of absolute honesty both with himself and his employer. He is old enough to realize that any neglect to properly assimilate the lessons given him for home study will but delay his progress and that it is up to himself to devote enough time to the home study work outlined, to enable him to keep ahead of schedule, and to be prepared at each session for the work to be done that particular day.

He should be taught principles of welding so thoroughly that he will be able to explain and illustrate to the instructor just what is required before attempting any new work. With a thorough understanding of what he desires to accomplish he is able to draw a mental picture of the work to be accomplished and from this picture to develop the ideal with practice. He must learn to test his own welds, discover defects in his own and the work of others by visual inspection; in other words, he must eventually become his own critic and get into that state of mind that will not permit him to turn out anything that may be unsound or of slovenly appearance.

Short Class Periods Essential

As previously stated, the periods of instruction should be brief. This not only materially lessens the cost of gases used (the one big item of expense in training welders) but gives the student a change from physical exercise with the torch to mental exercise devoted to home study, and (at such periods as the student can command) to muscular training with a dummy torch under a light in his own home. (This dummy can be constructed from an old broom handle or other short stick with a nail driven through near the end to resemble the angle of the tip. The shadow of this point is made to describe the motion to be imparted to the tip of the torch.)

It has been found by common experience that any new art can be more quickly imparted to the adult mind by means of a short lesson given daily than by means of continuous instruction. Some of the best operatives of the Standard Oil Company (records of Richmond, California, plant) are those who were trained in the company's own shop by attendance at their war-time night school three evenings per week. The same also holds good in training adults to operate motor vehicles. For example, the owner of a new automobile can be taught driving and considerable of the care of the machine in ten daily periods of one hour each. To try to impart the same instruction in one ten-hour session would be rank folly and no auto school in the country would make the attempt.

The operation of any mechanical device requires not brain work as is commonly assumed, but the training of the subconscious mind which is directly connected with the spinal column. Short lessons repeated at frequent intervals have been found to develop the subconscious mind most rapidly—in fact, more rapidly than when the lesson is drawn out to the point where fatigue causes the student to become nervous and to lose poise and self-control.

No operative is competent to operate a torch or other device requiring constant attention until his subconscious mind is so developed as to relieve the brain of all detail. If the driver of an auto must brain-think which way to turn the steering wheel when he turns a corner he is liable to make a mistake and come to grief. The untrained driver who fears a collision with a tree a hundred feet in front of his car will invariably effect such a collision. But when his subconscious instinct has been trained to operate the car any necessary movement of the wheel or gears is made before the brain has time to think.

In the training of welders it is necessary and essential to encourage home practice to cause the various details of operation to be passed on to the subconscious mind as rapidly as possible. "Whistle a waltz and move the torch back and forth across the weld." Whistling relieves the mind of worry and enables the instinct to grasp the details of operation more quickly. If the operator must brain-think to move the torch he cannot give proper attention to other details essential to the making of a sound weld. In fact, one can concentrate the brain on but one idea at any one time —the subconscious mind can carry out a dozen details simultaneously. Therefore, the welder must have the training that leaves him entirely free to watch the welding, and that training is possible only when he has completed a wise course of instruction that has corrected his faults, imparted sound principles, given him a correct perspective of his work and taught him to think for himself.

PRODUCTION METHODS FOR WORKING LEAD

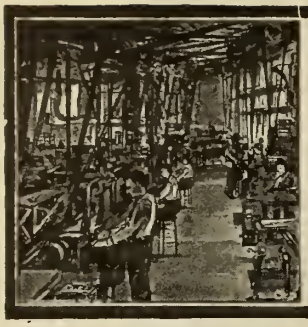
When casting ingots of lead or other metals of a similar nature, where rapid handling is necessary, the following method is advised. In the molten metal a centrifugal pump is situated. The method of driving is by a vertical shaft, which in turn is driven by a set of bevel gears driven from the horizontal shaft. From the pump a pipe leads out to a revolving fixture. The control of the lead is taken care of by the valve, which necessarily has to be kept hot by a flame from a burner so that the metal will not chill and stick the valve. The valve must be constructed of cast iron and the pump must have iron bearings, the shaft through which must be a "sloppy" fit.

Another instance is where one desires to cast small parts in quantities and the weight of them must conform to certain limits. This can be accomplished by the use of a quantity valve which I have shown in the sketch? This valve sits immersed in the molten metal and must also be constructed of a non-adhering material—cast iron. The stem of the valve has a chamber in it that holds just the proper amount of metal. It must be a taper-seated valve of course, and held in place by lock nuts at bottom. These can be of steel. The valve, as shown in sketch, is in the discharging position, having been turned 180 degrees from the loading position. In order that the valve will properly discharge, it is necessary that no vacuum be caused to retard the discharge of the metal. A vent pipe A is necessary to accomplish this, but admittance of air will cause the formation of oxidized refuse in the chamber, which will cause a variation in weight of the mold.

If the intake of this vent pipe is situated where it will draw in the flame from the burner beneath the tank of metal, no oxidization will take place and the weight will be uniform. The discharge B leads to a fixture of a revolving type where the molds are situated.

AIR TRIP FOR POWER PRESSES

A pneumatic device for the tripping of power presses and other machinery where difficulty is often experienced in reaching the starting treadle when handling the work has been brought out by the Lovejoy Tool Works of Springfield, Vt. The appliance consists of a cylinder and valve, and is secured to the frame of the press in such a position that the connection at the top of the piston may be bolted to the trip lever of the press. When the air is turned on the piston is raised and the trip mechanism is released. The piston and valve are brought back to the idle position by means of two springs. The valve may be operated from any position about the machine by the use of a cord that is held in the hands of the operator.



DEVELOPMENTS IN SHOP EQUIPMENT



RING TABLE

READERS will no doubt remember the article we had in our October 7th issue dealing with a Newton continuous miller. This present material deals with another type of miller produced by this firm and which has certain features well worth going into.

Figs. 1 and 2 illustrate this machine. The view shown at Fig. 1 depicts the roughing spindles, while Fig. 2 illustrates the finishing spindle. It will be observed that the same fundamentals of construction referred to in previous machine form a part of this one.

The base is circular in form, providing a central taper column. The table casting is fitted to the central taper column of the base, and in addition is provided with an annular bearing close to the periphery of the table. The cross rail and the central upright are made in one piece so as to reduce even on this large machine the number of bolted connections. The table is 84 inches in diameter and the depth from the annular bearing to the top of the table is 12 inches. The least diameter of the taper fit between base column and table is 36 inches. Table is provided with a finished hub 42 inches in dia neter to assist in locating jigs on the table. The central column is bolted and keyed to the base and the cross rail is fitted in the front with one housing containing two spindles for the roughing cut. On the back of the cross rail and at a distance of 42 inches is a similar housing carrying a single spindle for the finishing cut.

Roughing and Finishing

You will observe that both the housings for the roughing and finishing spindles can be positioned on the cross rail so that where machine is used for a variety of work the spindles can be positioned to the most economical location of the jigs upon the table so that the jigs can be made with the least angularity and the least loss of space between them. The outer end of the cross rail is supported by a column which is bolted and doweled to the base as well as the cross rail.

Drive is on the top of the machine, motor gearing to a jackshaft, and at the extreme outer end of the cross rail will be noticed a box which is used to transmit the motion from the jackshaft to the roughing and finishing spindles. This permits of a provision for varying the rotative speed of the spindles independently of each other, and whilst the speed is predetermined and fixed, this provision permits of changing the speeds when the grade of material or size of cutters is changed.

The rotative movement of the table is controlled by a fixed feed which is predetermined, but provision is supplied by which this rate of rotation can be changed to suit any change in the grade of material. There is not, however, any possibility of the operator increasing or decreasing the production of the machine as the rotative speed has been pre-determined, which means that a given number of stations per hour must pass the loading station, hence that number of pieces must be machined. The table itself is rotated by a herringbone gear 81 inches in diameter. Each of the spindles is provided with an individual adjustment for setting the cutters to gauges.

Different sizes of housings providing varying centres between the roughing spindles are used, depending upon the dimensions of the work. Generally, however, these centres are either 12 or 14 inches. Both spindles are rotated inward or clockwise on the left-hand spindle and counter clockwise on the right-hand spindle. With the distance of 42 inches from the centre of the roughing cutters to the centre of the finishing cutters, it



FIG. 1.



FIG. 2.

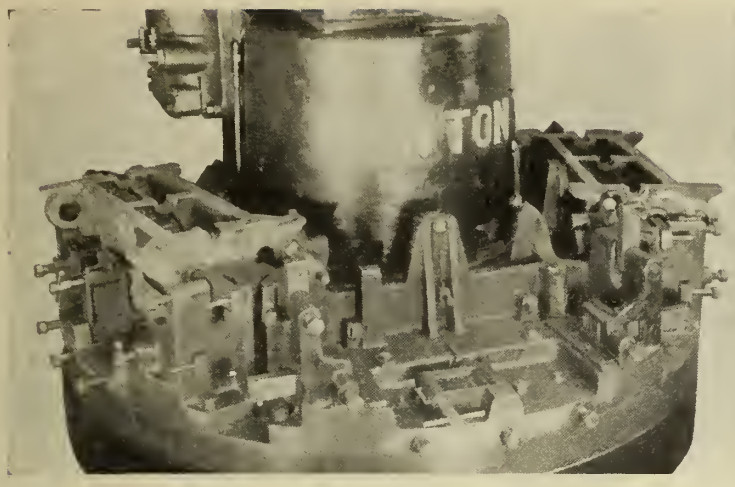


FIG. 3.

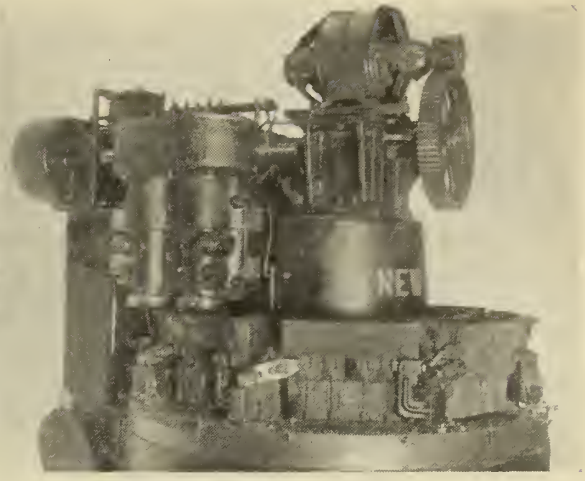


FIG. 4.

is quite clear that the roughing operation has been performed on a given casting before the finishing operation commences, hence the finishing cutter is relieved of any influence on the part of the roughing operation and due to the slight cut taken by the finishing cutter, any inaccuracy resulting from either dull roughing cutters or in equality of castings is picked up by the finishing cutter, insuring accuracy of both finish and dimensions. Correspondingly, by the division of the work, the number of grindings of cutters is reduced. Many instances are found wherein a high degree of finish is not required, but by taking the finishing and the correspondingly faster feeds, increased production is obtained.

The principle of roughing and finishing cuts permits of operating at much higher cutting speeds and table feeds than is practical by any other process of surfacing operations. All bearings, except the spindle bearings, are oiled by cascade method of lubrication, which is pumped from a reservoir in the outer upright to the box on the top of the machine from which point it is distributed.

For illustration purpose we show various photographs of work performed. Fig. 3 depicts the roughing operation on the base of a cylinder block, the dimensions of which are shown at A in Fig. 4. From the roughing operation depicted the finishing operation can be readily understood. On this work a feed of 20 inches per minute on the maximum radius of the work was used.

Fig. 5 depicts the method of jigging casting shown at B, Fig. 4. It will be noted that this jig is of the open front type, this permitting quick loading and unloading from a roller conveyor. The time for jigging the piece shown at Fig. 5 is less than one minute. These castings have been machined in two minutes, but the usual practice runs from 2½ to 3 minutes each, depending upon the requirements and supply.

Some of the features claimed for these machines are ruggedness in all operating parts, and an excessive amount of weight in view of the fact that the parts themselves are quite incapable of absorbing any of the vibration set up by all the cutting actions, hence the machine is designed to absorb such vibration. The character of work usually presented to these machines does not require a great range of adjustment, hence with the standard model this is taken up, first, by the adjustment in the spindle heads, and second by variation in the height of the jigs themselves.

All gears are enclosed and run in oil and all essential gears are hardened. Provision is made for stopping the table for setting the cutters by a conveniently placed lever. The bearings are all sealed to prevent the escape of lubricating oil.

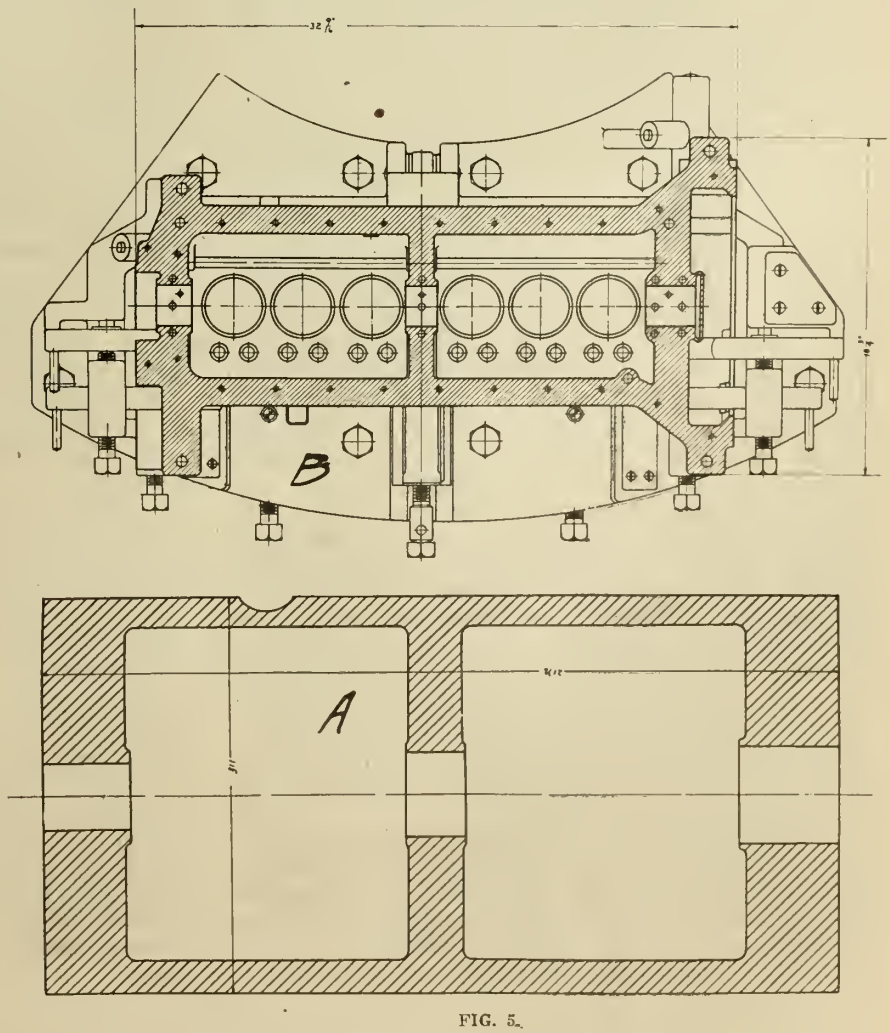


FIG. 5.

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The Bogey of Cheap Tools

CARE should be taken lest the talk of cheaper machine tools goes farther than the actual conditions of the case will permit developments in this direction to measure up to what the buyers expect.

There are greater considerations than the bringing down of the prices of machine tools.

There have been cases where buyers have purchased cheap machine tools. They have gone on the assumption that a lathe is a lathe and a miller is a miller. At the start they saved money on the purchase, but that was the only place where there was any saving.

A buyer in the average market gets what he pays for. If he clamors for a cheap outfit, he can get his wants attended to. And when he has got this outfit housed in his premises he has exactly what he paid for—a cheap outfit.

There are greater considerations now than that there should be a slash in the price of machine tools, and the chiefest of these is that the last word in quality and stamina shall be built into the equipment that is going to be used in the industrial areas of Canada.

It would be much better for the buyer of machine tools to pay the price that will allow the maker of them to put in them the best work, brains, steel and iron that can be secured. And having paid that price he will be within his rights in insisting that when he buys he shall get the last word in shop equipment.

There is room for improvement in the quality of the work turned out in many Canadian plants. Men who have been abroad and seen Canadian products in competition with those of other lands have recognized that in some cases there was need for greater exactitude in machine shop practice.

There are makers of machine tools in Canada who have never received enough for their product to allow them to go ahead and develop along proper lines. There has been, in some cases, not enough margin on the sale to permit of experimental and engineering expenditures.

It will pay handsomely to invest a sum for mechanical equipment that will include possibilities for betterment and expansion to the maker of those tools.

Prices cut to the bone mean production at a figure rather than at a standard. A machine tool is not like a pound of prunes or a bag of sugar. Its sale does not and should not depend on the shading of the price to the last fraction.

Don't clamor for cheap tools. Much rather pay the price and insist on the quality being as high as the price.

Adequate Boiler Inspection

IN an article published in the Toronto Star Weekly the Hon. W. R. Rollo has something to say on the subject of making labor safe. In connection with this, he states, there is a demand for the inspection of every boiler in the province, in addition to the insurance inspection. Mr. Rollo intimates that this demand among others will probably be met.

While we are entirely of the opinion that every boiler should be inspected, we can see no reason why a boiler owner who wishes to carry insurance should be penalized by two inspections. If he carries no insurance, then the Government should undertake the inspection in the interest of the public and at the owner's expense. Where the owner carries insurance, an inspection is made by the insurance company's inspector, who is generally, at least, as capable as the Government inspector. Getting a boiler ready for inspection is a matter entailing time and expense, and whereas an insurance company usually make their inspection fit the owner's convenience, this will hardly enter the Government official's mind. In many cases the insurance company make their inspection at a time when the factory is closed down, and the boiler opened up for cleaning in the ordinary way.

The Province of Quebec makes every insurance inspector carry a Government certificate of competency as a boiler inspector, and holds regular examinations for candidates for these positions. Having given this certificate, the inspector has all the status of a Government official as far as his reports and inspections go. Most large and many small concerns carry insurance for the protection it gives them. To compel them to submit to two inspections would be inflicting an unnecessary hardship.

The Business Outlook

THE average man in any line of business is always on the lookout for indications of how trade is moving.

This is true now in the machine tool trade in Canada and United States.

Here is a report from a large American firm that is worth noting:—

> "With the election over, the general tone of business in the last week or ten days has been better than at any time in the last three months. Collections, of course, are still very bad, but incoming inquiries and actual orders from all over the country indicate that the American people have every confidence in the next administration."

And in the Canadian field? Here's the opinion of one manager who handles a lot of business in the machine tool and equipment field:—

"We are doing less business now than last month, but we are not complaining. I believe we are right in the midst of the period of price adjustment, about which we have heard so much since the end of the war. When I see a plant laying off men I might feel very much discouraged were it not for the fact that at these same premises they are building large extensions for next year's trade."

Just Taking a Chance On That Extra Trip

THE month of November is not very far advanced before we hear of the loss of a Great Lakes freighter. Fortunately, in this first case, it was unaccompanied by loss of life, although the crew went through great hardships before they were rescued. In the same storm several vessels had narrow escapes, and one barge foundered, the crew being rescued.

As the end of the season of lake navigation draws near every voyage undertaken is a gamble with the god of storms. The lake freighter, evolved after many years' experience as the ideal vessel for the transportation of bulk cargo, has been so evolved without any thought being given to her seagoing qualities.

Frankly, she is expected to keep out of the way of bad weather, being utterly unfitted to contend with it. Yet every season a certain number of these vessels are lost, too often with all hands, or a large portion of the crew.

How does this happen? Is it that the captains of these vessels, knowing fairly well what weather to expect, and well aware of the capabilities of their craft, are so imbued with zeal for the owners that they start voyages in which every element is against them, in the hope of winning through?

Or is it the owner that drives them out, anxious to get the last cent that can be made from his property?

In some cases the captain may be the owner, or part owner of the vessel, but in that case he would not be inclined to take risks. The Great Lakes are well equipped with weather observation stations, and meteorological science has reached a point where the observed conditions, compared with similar conditions over a number of years, show the probabilities for at least twenty-four hours ahead with reasonable accuracy. Harbors are fairly frequent, and, for the most part, well buoyed and well lighted. Where then is the weakness? The weakness, undoubtedly, lies in the vessels themselves.

Pitted against the terrific storms that blow across the inland seas the structure collapses. The heart of the fabric, the power plant, is not capable of holding the body up to face the seas in the most efficient manner. The mass of steel, hundreds of feet in length, becomes, instead of a ship, a mere hollow girder floating on the waves. It is either driven ashore, where it is held as in a vice while it is battered to pieces by nature's hammer, the waves, or before ever it reaches shore the hammer has done its work. Whichever way it happens, the job is very completely finished, and, too often, a toll of human life is taken.

Is there a remedy? The only one that would be of any use is one which no government would dare to take. That would be to set an arbitrary date for the close of navigation, and is out of the range of practical ideas. So long as there are men willing to take the risk, so long will we open our morning papers to read of another wreck on the Great Lakes.

The Star Weekly in its financial section says:—"According to Iron Age, the present average price of eight leading iron and steel products is $7.75 a ton, whereas a week ago the average was $80.10." Now, then, who is going to rise to say that steel prices have not been cut, slashed, pruned, trimmed, skimmed, thinned, decreased, flattened out, deflated, reduced, battered down, and all else?

Pay Promptly If You Can

FINANCING is not an easy matter just now. It is a strange situation for a firm to find that it can secure plenty of business, but cannot finance them. There are in the steel and metal industries of Canada where that is the state to-day.

Collections are slower also. Firms that do not need to do so, in many cases, are taking advantage of every means of long distance financing known to them. They issue notes and keep postponing payment as long as possible.

The serious thing is that when any number of firms start this sort of business it is not long before we find the whole business community financing on long terms instead of prompt acceptances.

It is one sure and certain way to start a vicious circle that is extremely difficult to break or wind up at a desirable time or point.

It is necessary that every leniency should be extended to worthy institutions to-day, and it is not desirable that any of them be put to the wall.

On the other hand, it is equally necessary that, under the guise of this treatment, no financially able firm shall grab the opportunity of joining the list of paper and note financiers when they are able to pay their way.

What the Business Papers Say

GET STARTED ON THE RIGHT ROAD

Mechanical World, Manchester.—We know full well the difficulties manufacturers are laboring under, and there is no quick road to the deflation of prices. At the same time a start must be made, and it is not putting it too high to say that manufacturers as a body can more easily afford to bear some initial losses due to the effect of a fall in prices on existing stocks. Behind them, of course, often come the importers, who stand to be hit most. Good profits, however, have been made in the past, and if a long period of serious unemployment is to be avoided, heads had better be put together to find a way out.

THE INFLUENCE OF WAR ON MACHINERY

Iron Trade Review.—There can be no question that designers of machinery are profiting from the experiences of the war. Many specially designed tools created several years ago under stress are now being redesigned and improved. The most noticeable feature of this remodeling process is the tendency to adapt old types to semiautomatic operation. This is accomplished on boring mills, milling machines and similar tools by providing rotating tables with from four to eight chucks, so that the work may pass from one set of cutters to another for the various operations. For duplicate work, these machines greatly increase the output per man and in some instances it is possible for one operator to handle more than one machine.

OBSOLETE TOOLS ARE A NUISANCE

Machinery (New York).—Light cuts and slow speeds greatly decrease production, and the inaccurate work from many obsolete tools increases the time required for assembling machined parts. These old machines are also a source of discouragement to the men who must use them—a factor not to be overlooked. It is well known that locomotives are kept in repair shops longer than is necessary owing to the use of obsolete tools, and a careful study of conditions in representative repair shops shows that the loss from this source is even greater than is generally realized.

HIGHER WAGES NOW ARE DANGEROUS

Canadian Engineer:—Contractors and supply dealers are of the opinion that a reduction in wages, rather than an increase, can be expected. They say that living costs are slowly but surely reaching a lower level, and that propaganda for wage increases in the face of existing conditions in the construction industries is having a serious effect on general business. A vast amount of construction throughout Canada has been postponed in the expectation that prices of materials and labor would not remain at war-time levels very much longer, and propaganda for further increases is causing the total abandonment of many of these projects.

Motors and Their Correct Application

The Characteristics of Motors in Terms of Their Speed and Torque in Relation to Different Kinds of Loads is Discussed by the Author

PAUL AND LINCOLN

AN interesting paper bearing on the above title was read before the Toronto Electric Club by Mr. Paul Lincoln of the Lincoln Electric Co., recently.

Mr. Lincoln prefaced his remarks by some reference to the historical side of power development, and quoted largely from a book called "The New Epoch", by George S. Morison. Mr. Lincoln especially drew attention to a quotation occurring in that book, as follows: "Wherever needed, we can now produce practically unlimited power." Mr. Lincoln used this quotation as a text for his talk, which here follows:

The particular point that I wish to make is that the significant thing that is bringing about Morison's "New Epoch" is not entirely the "manufacture" of power, but largely the ability to distribute this power to "wherever needed," and that latter ability is the distinct contribution of the electrical profession. It is the problem of distribution that has been solved most completely by the alternating current polyphase system. The ease, efficiency and safety with which alternating currents can be changed from one voltage to another by means of the static transformer has given that system so great an advantage that it has no competitors, in so far as the distribution problems are concerned. In point of adaptability to driving the great multiplicity of loads that motors are applied to, the alternating current motor lacks some of the flexibility of the older direct current motor.

Before the advent of the alternating current polyphase motor the direct current motor had a considerable vogue, and in some applications its greatest flexibility has caused its retention in service in spite of the increasing prevalence of the alternating current polyphase distributing systems.

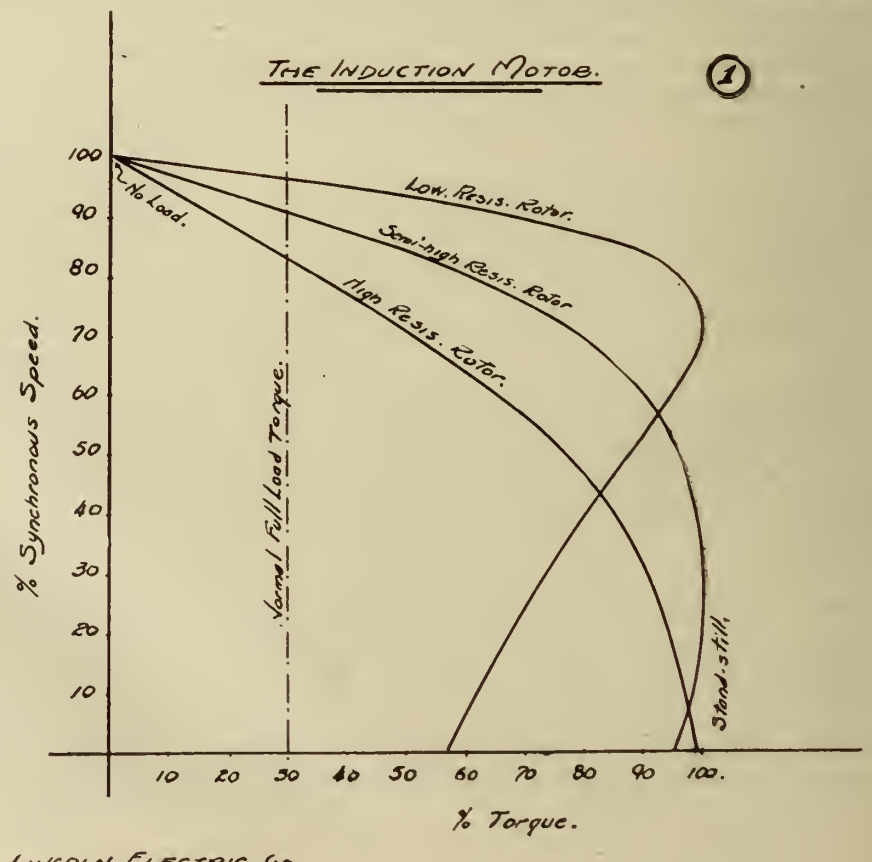
The contest that has been waged between A. C. and D. C. during the last 25 years has gone in favor of A. C. not because the A. C. motor is more rugged, but solely due to the superiority of the A. C. for distribution. It is the ability to put power "wherever needed," in the words of Morison, that has won the battle for the alternating current. The problem of applying motors to the diversified work that they have to do is in general more easily solved by the D. C. motor than the A. C. However, by careful analysis of the work the motor has to do as well as a complete knowledge of the characteristics of the A. C. polyphase motor; the A. C. motor has been successfully applied to every class of work that motors are called on to do.

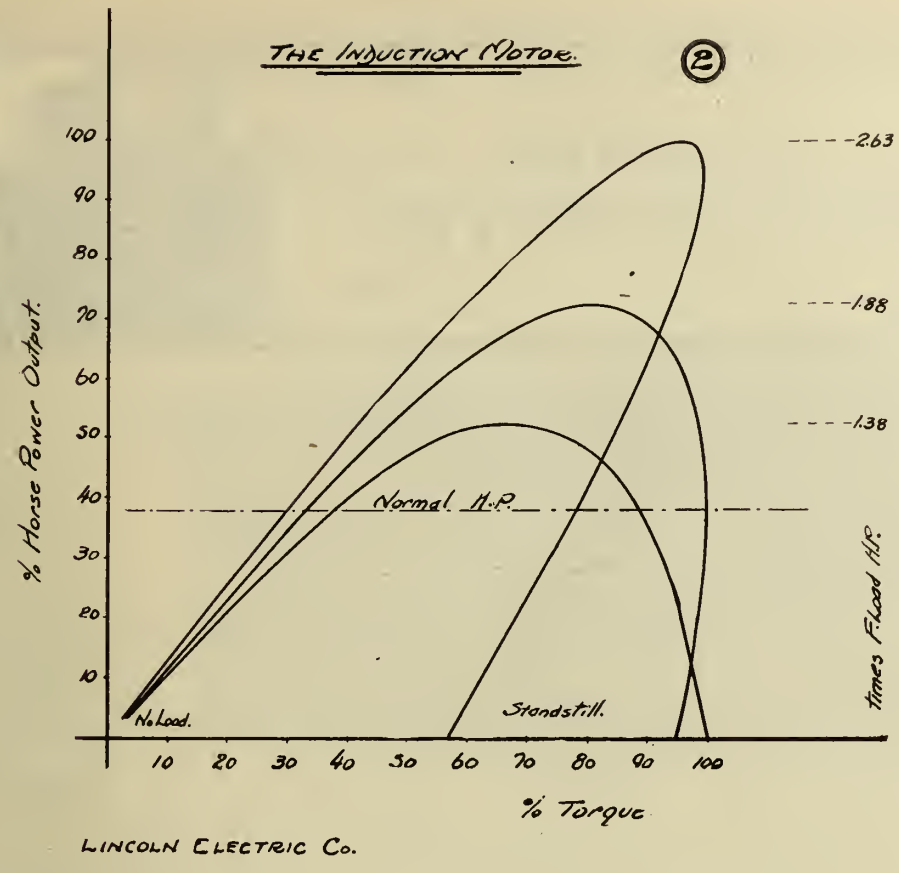
The ease of distribution of A. C. polyphase currents is bringing about a complete revolution in the method of operating our modern factories. Time was when the water wheel or the steam engine was a source of power, that it was customary to equip a factory with a single prime mover, and then distribute this power throughout the plant by means of shafts and belts. During this period, shafting and belting took so firm a hold that it is exceedingly difficult now to think of a factory installation without thinking of a room full of shafting and belts.

The "wherever needed" is not a single point in the factory, but the individual machines that are operated therein. To carry Morison's dream to its logical conclusion, we must power equip, not a factory, but the individual machines in that factory. The electric motor is successfully taking the place of the steam engine in factory drive, but its job is only half done when we substitute a motor for the former engine and leave the belts and shafting. The job is completely done only when the idea of motor drive is carried to the ultimate of the "wherever needed" that Mr. Morison emphasizes.

Now the problem of applying motors to the ultimate machine wherein power is used involves first an analysis of the power characteristics of these machines, and second a complete knowledge of the nature of the motor to be applied and of the modifications of design that are possible thereon. The most important characteristic of a load, at least, when considered in connection with a driving motor, is its speed torque character. The most usual demand in this respect is that the speed shall be independent of the torque or practically so. When factories were driven by a single prime mover, either water or steam, this constant speed characteristic was the one demanded and when electric motors began to supplant other prime movers, it was natural that this constant speed characteristic should be the one most in demand. Both the A. C. and the D. C. motor were able to meet this requirement easily.

A second requirement often demanded in a load is the ability to adjust the motor speed to a new value and when so adjusted, still to have its speed independent of its load. This is a require-





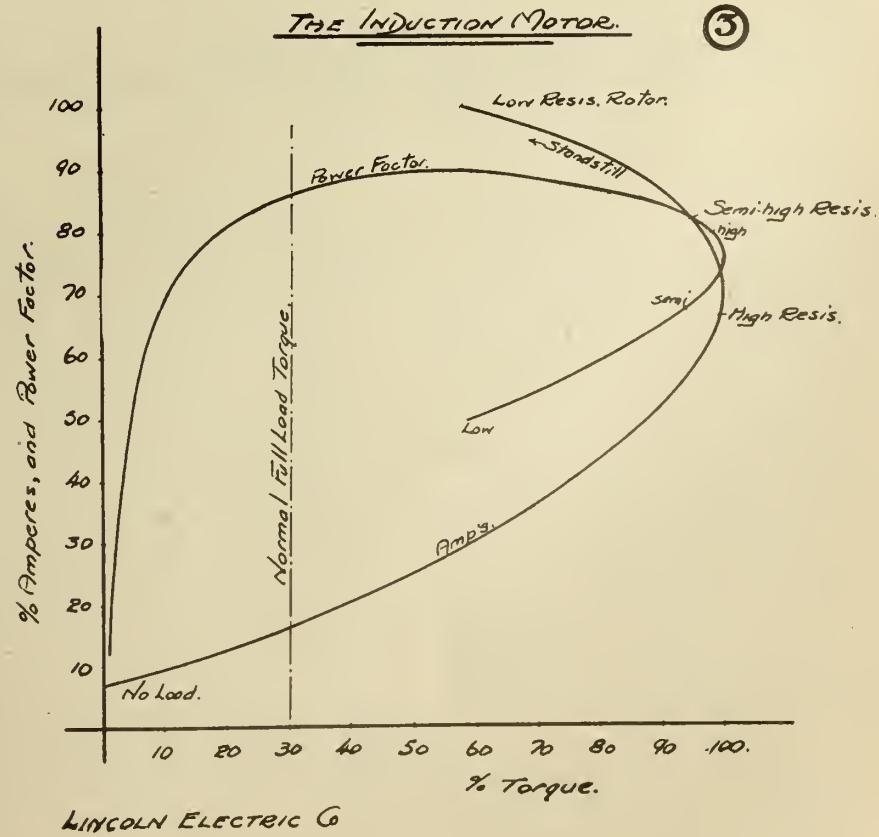
ment that can be met by the D. C. motor with relative ease, but is impossible of fulfillment by the A. C. motor. It is this requirement that has done more to keep the D. C. motor in service in competition with the A. C. than any other one requirement. Machine tools is the particular duty where this requirement is most in demand. The absence of this ability to give constant speed characteristics over an adjustable range of speed is the A. C. motor's weakest point. Methods of securing this ability with the A. C. motor undoubtedly will be forthcoming in time; but whether they can be secured at a reasonable cost and, what is most important, without a sacrifice of the ruggedness and reliability of the induction motor, is a still unanswered question.

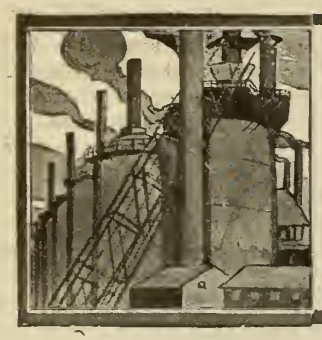
A third load requirement frequently called for is one where torque forms the important element rather than speed. Such loads are typified by the elevator and the hoist. In applying motors to such loads, constancy of speed with carying torques, is of no consequence. The type of motor to meet such requirements successfully is quite different from the first two where constancy of speed is essential. The operation of railway cars and trains is another example of load where torque plays a much more important part than speed.

The above three classes of load are only a part of those that are met in practice. Loads may be classified not only in regard to their speed-torque characteristics, but also in regard to their power-time character or the "intermittancy" of the load. Consider for instance the power-time character of a punch-press or a forging press. During a large part of the time of operating a machine of this kind, the only duty of the motor is simply to turn the machine over idle. At intervals, more or of the work, power is expended on the work for a short time, after which there is another period of comparative rest. In a punch-press for instance, the time during which power is actually being expended in shearing the metal is exceedingly small, but during that small instant the rate at which power is used may be exceedingly large. In such applications, it is customary to use a fly-wheel which stores sufficient energy to do the active work of shearing the metal and then rely on the motor to restore the energy to the fly-wheel during the comparative long interval between successive strokes. The characteristics of a motor for this work obviously differ materially from that to operate a lathe for instance, where the work is done at a uniform rate. Or take the case of an elevator motor; the rate of doing work here varies greatly between the starting period, when it is necessary to accelerate the car and its load, and the running period, when it is necessary simply to lift the load. Also, the load on the motor varies greatly depending on whether the car with its maximum load is being lifted or lowered. The motor obviously must be of different size and character to care for the maximum conditions that are imposed upon it, and the problem of the proper rating to give the motor that does the work properly is not an easy or a simple one.

As indicated in the foregoing, the problem of applying a motor to its load is first—a thorough understanding of the nature of the work to be done, and second—a thorough understanding of motor characteristics and the modifica-

Continued on Page 64.





MARKET DEVELOPMENTS



A Quiet Season in Tools, Iron and Steel

Trading is in Small Quantity, But There is Generally a Dull Season at This Time of Year—Steel and Iron Prices Stay Up Much Longer Than Figures in the Non-Ferrous Lists.

BUSINESS is quiet in the machine tool, iron and steel market. But in saying that one should take into consideration that at any time this is a quiet season in these lines. Little purchasing is ever done in the steel market during the last half of November and December, and it is hard to say how much this accounts for the present state. Prices are holding firm, though, and if there is any tendency in the U. S. steel market to let prices sag seriously it is not being reflected here. In some lines the demand is good and deliveries not in keeping with the immediate requirements.

It is doubtful if a decrease in prices would bring much new business into the market just now. As a rule, machine tools are not sold because the price is attractive, but because they are wanted to do a certain work, buyers preferring to pay the high price and insist on the quality being equally high. Some makers have announced reductions, but the movement has not become general. It had been expected that the meeting of tool builders in New York would be followed by something approaching a general announcement regarding policy and prices for the ensuring year, but so far there has been nothing forthcoming apart from the announcement of the president that costs were still very high, and would hardly permit of reductions. Tool builders in Canada are in the same position, and it is very doubtful if they can make reductions that would assist sales.

Buying in the small tool division is small, and the territory is being combed for business more thoroughly than any time since the beginning of the war.

The scrap metal market is becoming known for the business it is not doing, rather than for any volume of trading that is taking place. Prices have been cut to the bone, but the market remains the same, listless and inactive. The big buyers, even at low levels, are not in the market.

CLOSE OF NAVIGATION IS FELT IN BUSINESS AT MONTREAL NOW

Special to CANADIAN MACHINERY.

MONTREAL, Nov. 18.—The near approach of the close of navigation is having its effect on trade in this district. It is expected that for a short period at least the railroads in this locality will be additionally active in hauling freight to the seaport of St. John, N.B., which port will carry on the bulk of the winter trade to and from overseas. Reports seem to indicate that business is gradually developing a quieter trend, particularly in manufacturing lines. Business in machine tools has shown a slight falling off, especially in orders on new equipment. Supply demand is steady. Some dealers report fair business while others infer that turnover is light. The aggregate business is possibly lighter than for some time, but dealers are not discouraged as they realize the present dullness is quite seasonable, owing to the nearness of the year's close.

Lower Levels Anticipated

There is a marked tendency in all quarters to liquidate supplies on hand before further placement of orders. When buying is necessary a conservative policy seems to rule, and in consequence the market in every direction has taken on a dullness that promises to continue for the remainder of the year, with possibly a slight fluctuation both in price and volume of business. The consumption of materials for industrial enterprise is gradually lessening, and with mills and furnaces endeavoring to maintain operations, rather than reduce their staffs, the available supply of many commodities is in the ascendency, and with very few exceptions the cry of "shortage of materials" is seldom heard. Premium business is seldom reported now. Dealers are not anxious to acquire large warehouse stocks, but are trying to keep sufficient on hand to meet their customers' needs as they arise. While the factor of price is, no doubt, an influence in keeping the consumer from buying ahead, the chief difficulty is the uncertainty that features the industrial situation at the present time. Should weakness develop to the point of heavy price cutting the element of labor would necessarily have to be taken into serious consideration, as existing conditions in this field prohibit profitable operations unless relative reductions are effected in the cost of production. Steel quotations are generally firm but the factor of price is of minor importance in face of the poor demand. Price revision on the market basis doubtless is pending, but dealers are reluctant to take definite steps in this direction until the turn of the year. It is possible that actual orders would bring out better figures than those quoted, but with trade on the ebb, dealers are satisfied to let the nominal prices stand.

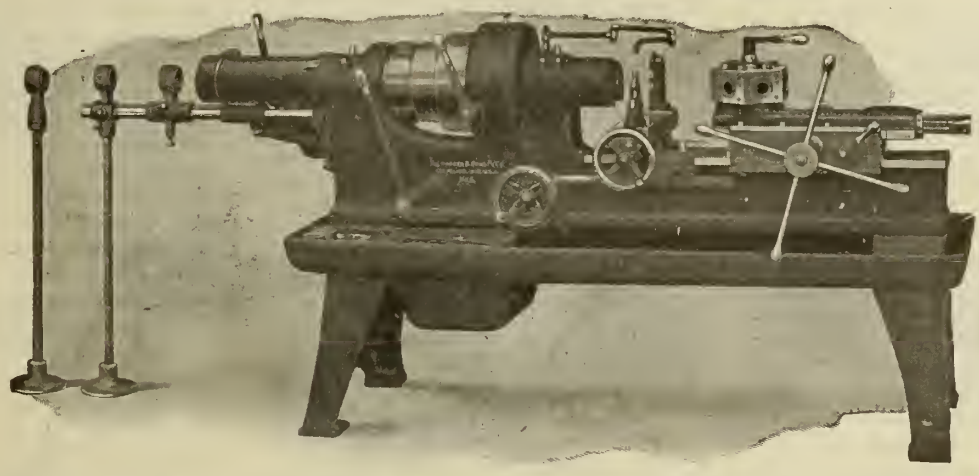
Additional Weakness Develops

Absence of activity in the old material market has added to the dullness that has been more or less marked in this field for some time. Despite the declining trend of prices on almost every line of scrap, the lack of interest on the part of consumers keeps the situation in a state of listlessness. Conditions are not conducive to heavy buying of scrap and

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users are content to acquire scrap sufficient to meet their present needs, leaving the future to look after itself. There seems little hope that business will show improvement during the next two months, and the outlook for the early period of 1921 is shrouded in uncertainty. Further reductions have been made by dealers here and quotations reflect the inactivity of the general situation. The range of decline in non-ferrous lines is from ¼ cent on heavy lead to 2½ cents on heavy copper. Crucible copper is now quoted at 13½ cents and light at 10½ cents per lb. Almost the entire list has been affected. Iron and steel lines are again weaker, the declines ranging from $1 a ton on machine shop turnings to $5 per ton on boiler plate and wrought iron axles. Malleable scrap at $23 is quite firm. Volume of scrap movement is exceptionally light.

BUSINESS QUIET IN SOME LINES

But Even In Normal Times There Is Generally a Lull at This Season of the Year

TORONTO.—The market is quiet now in several departments. It is very easy to go wrong in estimating how much of this is seasonable and how much is not. Many lines of business became accustomed to going through war years with no off-seasons, so that they have come to expect the same thing is going to hold good in the markets for all time to come. There are lines, several of them in fact, in the iron, steel and machine tool fields that have always been more or less flat at this time of the year, and this season, being about the first when trade is on the way back to more normal conditions, is apt to be looked upon as exceptional because it does not measure up to war years or to the unexpected conditions that followed the war.

Trade in machine tools is quiet. One may advance many explanations for this, but it does not alter the fact. Many firms have some very interesting quotations out now, and they expect to convert some of these into real business. The matter of price is discussed openly, and there is a very marked difference of opinion as to whether a reduction would assist in the sale of any more machines under present conditions. The experience of several dealers can be summed up in the opinion of one who stated, "Nearly every sale that we are making now is made because a firm realizes the need for a new tool in some department. They see where there can be a saving made by the introduction of the new equipment."

"I am open to admit that our business is not brisk now," stated one firm to Machinery this week, "but what of it? One has only to look around a little to see ahead and anticipate what is coming. I can take you to a plant where a number of men have been laid off. On the face of the thing that is not very hopeful, is it? But go on around to the other side of the same premises, and you will see that they are busy putting up a great extension to their existing place. Does that really look as though they see the bottom dropping out of things around here? No, it means that they are getting ready for a lot of business they hope to do next year."

Selling Small Tools

Firms handling Canadian high speed are working on the new list, announced in last week's issue of Machinery. This price schedule puts them on an equal footing with the British firms, which have heretofore been able to sell under the Canadian quotations. Business is not brisk, although there are a number of small orders to handle. One thing is certain, and that is that the shops are being combed for business now as they have not been for some time, and the dealers are putting on more steam than usual. In fact, there is a revival in selling in all lines of machine tools, including the small tools.

There may be a tendency on the part of some dealers to put certain parts of their stock up for clearance at this time of the year. Many of them end their fiscal year in the near future, and in order to make the year's business as good as possible, an extra selling cam-

paign may be inaugurated to move as much stuff as possible, even in this dull season.

Referring to the recent reduction in the price of high speed, one of the dealers remarked, "In this case we simply have to take our loss and go ahead. When the prices of goods in stock go up we stand to gain, and when they go down we have to take our losses. It can't be a case of 'we win' all the time."

The Steel Market

There has been some improvement in deliveries during the week, and some shipments are coming to light that have been on the books of the U. S. mills for almost a year.

Prices are remaining firm, and there is nothing in the local markets to reflect a dropping away from the selling schedules that have been in use for some time. It would be nothing out of the ordinary were business to fall off a little at this season, as it has been the experience of steel merchants in normal times that from now on to the first of the year business has never been brisk. Allowance should be made for this in considering the volume of trade that is passing now. There is a good demand for certain lines. The larger sizes of tubes seem to be fairly well supplied for this season. Many plants have decided to go ahead with existing equipment for the season as they cannot close off now. This affects the larger sized tubes, but there is still a demand for the 2-inch variety for the smaller plants, and it may be some time before the demand for these is satisfied.

Scrap Still Dull

"Nothing better in sight," was the comment in the scrap metal market this week. Trade is very weak, and the tonnage that is moving is limited to contract commitments. Dealers find that buyers are not coming into the market even at lowered prices.

In this connection it seems necessary to again call attention to the fact that the prices quoted on another page of this paper are Dealers' Buying Prices. That is, Toronto dealers will pay those prices for material. We have had several requests wanting to know where scrap material could be secured at the prices mentioned. It is almost impossible to get together a fair resale list, as selling is done subject to a good many conditions. If firms want to buy direct from those having scrap metal to sell, we would advise their use of the advertising columns of this paper, stating just what they wanted to secure, and they would probably find out then how much they could get.

POINTS IN WEEK'S MARKETING NOTES

Cancellations are coming in, although they are not at as great a rate as formerly.

Lead is now 50% above the 1913 price; zinc 20% above; copper 6% below; tin 15% below; pig iron is 172% above, and finished steel products in general 110% above.

Independent steel mills are maintaining prices in nearly every case, believing that reduction would not bring them any new business.

Pittsburgh reports state that independent steel mills are freeing bars, shapes and plates at 3c, and that 6c is a common quotation for black sheets 28 gauge. The National Machine Tool Builders met in New York, and although the quotation of prices was discussed at some length the general feeling seemed to be that when the costs of production were so high at the present time there was small chance for reduction to be made in price.

Firms that are selling lines that are used largely by farmers report business as being very active and sales are very satisfactory.

Steel merchants in this district are doing very fair business, although at this season of the year, even in normal times, there is always a falling off in the volume of trading.

The new price list which is being used by the Canadian high speed tool trades, now meets the price that has been used by the British firms for some time. Heretofore the old country high speed has been able to undersell the Canadian production.

MACHINE TOOL BUILDERS HAVE NOTHING ON PRICE REDUCTION

Special to CANADIAN MACHINERY.

NEW YORK, Nov. 18.—The National Machine Tool Builders' Association held in New York last week its nineteenth annual convention. Quite naturally the present business situation was the principal topic of discussion both in and out of the convention hall. President Albert E. Newton, in his opening address, pointed out the problem which the average machine-tool manufacturer faces, namely, the expectation on the part of the buyer that prices will go lower and the fact that costs of manufacturing machine tools are little if any lower. Mr. Newton expressed the conviction that price reductions at this time would avail nothing in stimulating renewed buying activity. This sentiment was echoed generally by the manufacturers attending the meeting, and the impression was gained that many, if not all of them, will cling to their present price schedules for the present, at least.

Cancellations were also discussed. The fact that some machine-tool manufacturers have had cancellations aggregating several hundred thousands of dollars made this subject of unusual importance. The machine-tool builders were at a loss to suggest any way by which cancellations may be minimized in a time like the present, except by a process of educating the buyer that he must feel a larger share of responsibility in placing an order. "A reawakening of the business conscience is needed," according to one speaker.

While there was no concealment of the fact that machine tool business in the United States has at present hit what is possibly the worst slump in its history, there was no pronounced feeling of gloom at the convention. Rather, the machine-tool manufacturers look for a resumption of business activity within a few months, by spring at the latest, and possibly sooner, and most of them are understood to be financially able to weather the storm.

In the local tool market there is very little change. Some sellers seem to detect a slightly better tone, as evidenced by a few more inquiries, but it is certain that if there is any improvement it is not general. Some tool builders are doing little or nothing here. There are expectations of railroad buying, but as before reported these prospects are somewhat nebulous as yet.

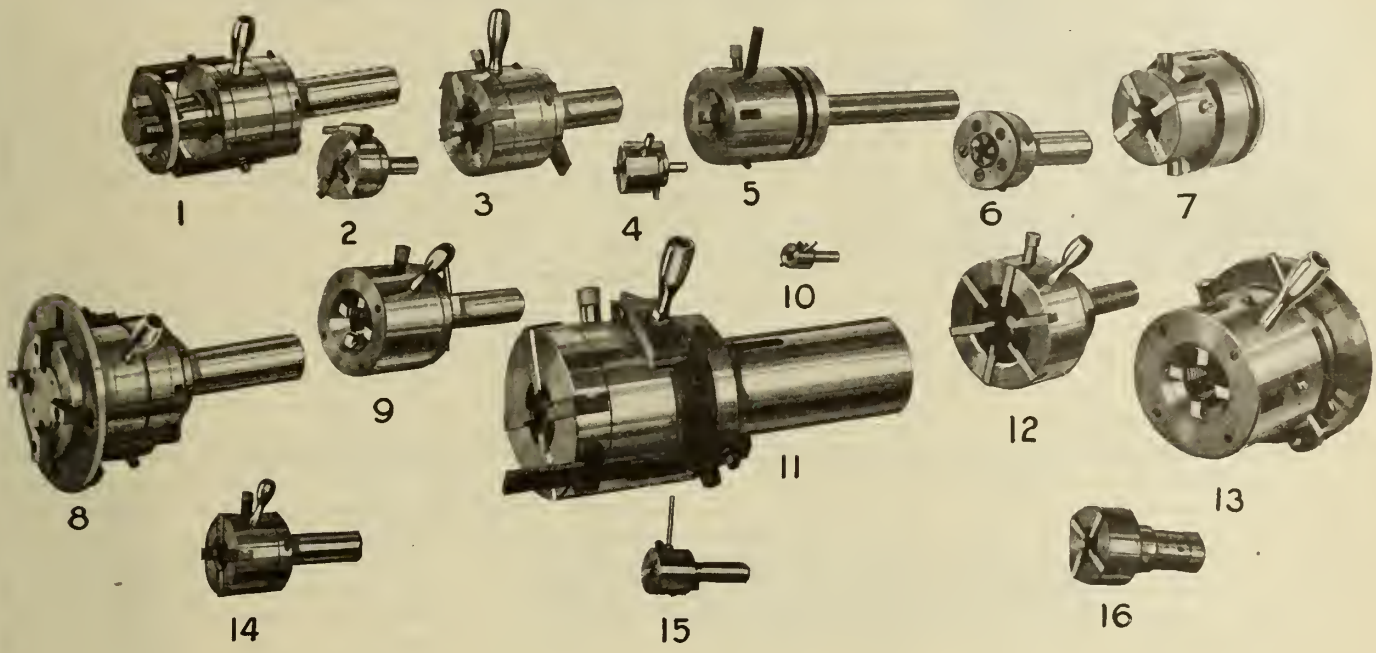
The General Electric Co. has issued a new list of about 20 tools, including 10 lathes, for a new plant which it is reported may be built in or near Newark, N. J. As the General Electric Co. has other pending inquiries, on which no action has been taken, the abovementioned list has not occasioned as much interest as might otherwise be expected.

Would Sell Its Plant—The plant constructed by the Brantford Industrial Realty Co. for the A. C. Spark Plug Company in the Holmedale district of Brantford, has been placed on the market as a result of uncertain conditions in the automobile industry. An officer of the realty company stated there was a possibility that the Spark Plug Company would start operating next spring, but any offers for the purchase of the plant will be entertained.

Increased Output.—Alberta's output of coal for 1920 has increased 30% in excess of last year's. A total output of over 6,500,000 tons is expected by the end of the year.

GET THEIR NUMBER

Numbers 1 to 16 represent one of the Geometric Self-opening and Adjustable Screw Cutting Die Heads, Solid Adjustable Die Heads and Adjustable Collapsing Taps.



No. 1—Class N-L Pipe Tap. Made in sizes from ¾" to 10" inclusive. Represents tapped diameters of 1-1/16" to 13-1/2" straight threads, and 3/4" to 12" standard pipe threads.

No. 2—A Geometric Brown & Sharpe Taper Turning Tool.

No. 3—Style C Die Head, Lever Trip Type. Recommended for cutting threads of short length.

No. 4—Two-Chaser Class U Tap, for tapping fine pitch threads, ranging from 1/2" to 1-5/16" diameters.

No. 5—Style D-D Die Head for Cleveland Automatic. Floating and tripping adjustment features make this a very desirable Die Head for these machines.

No. 6—Adjustable Hollow Milling Tool. The cutters are readily removed for sharpening. Micrometer adjustment makes quick and easy settings.

No. 7—Rotary Die Head. Recommended for live spindle use.

No. 8—Class P Tap, Plate Trip Type. Used wherever tripping plate can come in contact with the work.

No. 9—Style D Die Head. For general use where thread is not too short. Made in sizes from 5/16" to 4-1/2" inclusive. Represents threaded diameters of 3/32" to 4-1/2".

No. 10—A 1/8" Style D Die Head, the smallest size. Cuts down to 1/16" diameter thread.

No. 11—Taper Threading Die Head, with inside trip and roughing and finishing attachment. Recommended for coarse pitch taper threads.

No. 12—Style C Die Head, Inside Trip Type. For cutting short threads where the length of thread is best controlled by an adjustable internal gauge or stop.

No. 13—Style D-D Die Head, with roughing and finishing attachment. Flanged for Warner & Swasey Turret Machine.

No. 14—Style C Die Head, Pull Off Type. For cutting threads on light work.

No. 15—Style C Die Head for Brown & Sharpe Automatics.

No. 16—Solid Adjustable Die Head with floating shank, for Gridley Automatic.

These Die Heads and Taps are adapted for use on the turrets of practically all makes of hand and automatic screw machines and turret lathes.

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If interested tear out this page and place with letters to be answered.

STEEL AND IRON STAY UP MUCH LONGER THAN MANY OTHER LINES

Special to CANADIAN MACHINERY.

PITTSBURGH, November 18.—Open market demand for steel products continues extremely light. There is a fair, though slowly dwindling, demand for steel products against contracts. Some cancellations are still coming in, though not at as great a rate as formerly, and there are some postponements. Thus far at least the Steel Corporation has not been affected, but all the independents have had to restrict production more or less, even those that had order books apparently well filled, and this decline in independent steel production promises to continue until there is a fresh buying movement to replenish order books. The prospect of such a change is more indistinct than it appeared two or three weeks ago, for the general business situation is worse than it seemed to be recently.

Iron and Steel Exceptional

Indeed, a proper appraisal of the prospects requires the fact to be emphasized that the iron and steel industry is exceptional among industries as to its present position. No matter what the prospects may be, the iron and steel producers are making money now, and they have been making a great deal of money up to date. Practically all other industries have been in bad shape for weeks or months. The automobile, tire, textile and various other industries have come almost to a standstill, and with large stocks of manufactured goods which they find it difficult to liquidate. In the non-ferrous metals there have been very heavy losses. Lead is 50 per cent. over its average price in 1913, zinc is 20 per cent. above, copper is 6 per cent. below and tin is 15 per cent. below. Iron and steel prices make a sharp contrast with these metal prices, for pig iron, even with the recent declines, is 172 per cent. higher. The finished steel excess over 1913 would be greater still were not the Steel Corporation prices given some weight in determining the general average at present.

So much for price comparisons. As to demand, it is true there is very little demand for pig iron and steel products in the open market, but the production is being taken on old contracts, and the production is off only a few per cent., hardly much more than 10 per cent. from the high point, and it is fully one-fourth, perhaps one-third, greater than production in 1913. As the production is being taken, and as both producers and consumers are endeavoring to decrease stocks rather than increase them, the rate of consumption is evidently large, whereas for many commodities there is almost no demand at all.

The natural deduction to be made from this remarkable divergence is that the iron and steel industry is simply running on its momentum. It cannot expect to continue prosperous when other industries are not, but rather, when it will certainly take considerable time for business in general to revive from the very poor situation now existing, one should conclude that in iron and steel "the worst is yet to come."

Steel Production

The monthly report of the American Iron and Steel Institute indicates that production of steel ingots in the United States during October was at an average rate of about 42,950,000 gross tons a year. That is one-half of one per cent. heavier rate than the rate in September or August, the highest rate since last March, and the highest rate since December, 1918, barring February and March of this year. Yet during October it was well known that many producers were decreasing output. It seems strange that the total should have increased at all. The explanation is that the Steel Corporation, being well fitted with business, endeavors to run full, and experienced somewhat better operating conditions in October, while as to the independents, their decreases were progressive during the month and their average for the month was well ahead of their present rate of output. The November and December figures of production will probably show sharp decreases from the October rate.

Prices Slow to Yield

If any independent steel producer is selling any description of steel at the Steel Corporation (Industrial Board) price the case is altogether exceptional. As a matter of fact the independent prices are very slow indeed to yield to what is considered the inevitable, a decline in the independent market to the Steel Corporation level. As an augury for the future that can hardly be considered as altogether favorable. The mills have no agreement to maintain prices, nor are they receiving anything like enough business to support the market. It seems clear that the mills that are maintaining prices are doing so because there is so little temptation for them to reduce prices, no business of consequence being offered. There is a lack of competition not because mills refuse to compete but because the subject matter for competition is lacking.

On bars, shapes and plates the common quotation of independents is 3.00c. No doubt there is shading in some cases but there does not appear to be much. Sheets, however, show a constantly declining tendency, 6.00c being now done easily on No. 28 black. For several weeks the black sheet market has declined at an average rate of about a quarter cent a pound per week. Blue annealed in the heavier gauges could probably be had at about 4.00c, though for 14 to 16 gauge the price might be nearer 5.00c basis. Galvanized are about 1.50c above black.

Easily the strongest item in the finished steel list is tubular goods. There is heavy demand for shipments on contract, customers desiring mills to make heavier shipments than they are able to make. While the independents generally have a basis price, $7 a net ton above the Steel Corporation (54 per cent. as against 57½ per cent.) some orders even now are being taken at delivery premiums ranging up to $10 a ton, or $17 altogether above the Steel Corporation price.

Pig Iron

Since last report foundry pig iron has been offered by producers at $40, valley, or $1 under the reduced price of a week ago. Bessemer and basic are steady but extremely quiet. The market now stands at $40 for foundry, $42 for Bessemer and $38.50 for basic, f.o.b. valley furnaces, these prices representing declines from the top point, reached last August, of $10 on basic and foundry and $6.50 on Bessemer. Prices have slid off very easily, with practically no resistance, but furnaces are taking a new stand. They feel that enough has been done by way of reductions that were almost voluntary in character, and assert that if consumers want still lower prices they will have to offer orders that would make it worth while to cut prices. As there is no likelihood of consumers getting in the mood in the near future to buy to any extent, no matter what the prices, the furnaces feel they might as well save some of their ammunition. Very recently it was a common guess that pig iron on this decline would find its level at not under $30 nor over $35, but it looks now as if the readjustment will prove more drastic than a decline only to $30.

Serious Car Shortage.—Another serious car shortage is said to threaten Drumheller's mines. There are only enough cars to keep seven mines working part time and there are no more cars in sight, although the demand for coal from the rest of the prairies which are not stocked up with coal is increasing. One thousand men are idle and two thousand will be idle when the daily output of 7,000 tons will be cut off.

Annual Meeting.—One change was made in the officers of the Cockshutt Plow Company at the annual meeting, E. A. Mott being added. The directors are: Col. H. Cockshutt, George Wedlake, G. K. Wedlake, Sir Augustus Nanton, E. A. Mott, Sir Lomer Gouin, H. W. Hutchinson, James Adams, E. Perry. The reports presented were reported as very satisfactory to the shareholders.

Aikenhead's

Single Spindle Hand Tachometers

Hand Tachometers supply the need for accurate, durable and handy speed recorders for all-around use. They indicate accurately the revolutions per minute, **either right or left hand,** of shafts and spindles; furthermore by using the measuring disc, periphery or surface speeds are determined. The result (either revolutions per minute or feet per minute) is instantly shown on the dial **without watch-timing or calculating** of any sort. The slightest **variation in speed** occurring during a fraction of a minute is also shown **at a glance.** Belt slipping and consequent loss of power is, therefore, quickly detected.





Wahlstrom

Self-Centering, Automatic Drill Chucks

With a Wahlstrom, two seconds is all you need to change the operation from drilling to reaming, counterboring, or tapping—and you don't stop the spindle; simply grasp the chuck with one hand and replace the loosened tool with another.

The instant-acting jaws of the Wahlstrom close on the entire shank with a grip that becomes firmer and firmer as the resistance to the tool increases.

Made in two styles. One holds Nos. 1, 2 or 3 Morse Taper Shank Tools—with or without tang. The other is made in three sizes—15-64 to 1-2 in.; 3-8 to 3-4 in. and 17-32 to 1 in., thus holding all sizes of straight shank tools from 15-64 to 1 in. Booklet upon request.

Canada's Leading Tool Supply House

Our large stocks enable us to supply "Everything in Tools." We are prepared at all times to fill your requirements promptly---be they large or small. This, and efficient, courteous service has made Aikenhead's **Canada's Leading Tool Supply House.**

Aikenhead Hardware, Limited

17 Temperance Street, Toronto, Ont.

If interested tear out this page and place with letters to be answered.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	48 00
No. 2 Foundry, 1.75 to 2.25%	46 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 75
Steel bars, base, Montreal	5 75
Reinforcing bars, base	5 50
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	8 50
Chequered floor plate, ¼ in.	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	3 50
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	5 50
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 67 to 5 50
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	58½	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

METALS

	Gross. Montreal	Toronto
Lake copper	$21 00	$21 50
Electric copper	20 50	21 00
Castings, copper	20 00	20 00
Tin	52 00	52 00
Spelter	9 00	10 00
Lead	8 25	9 00
Antimony	8 50	10 00
Aluminum	36 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 35
Plates, ¼ up	6 50	6 60

PIPE—WROUGHT

Standard Buttweld Pipe

Per 100 Ft.

	Steel Blk.	Steel Galv.	Gen. Wrought Iron Blk.	Gen. Wrought Iron Galv.
⅛	$ 6 50	$ 8 50	$.....	$.....
¼	5 31	7 41	5 91	8 01
⅜	5 31	7 41	5 91	8 01
½	7 10	8 63	7 95	9 48
¾	8 80	10 87	9 95	12 02
1	13 01	16 07	14 71	17 77
1¼	17 60	21 74	19 90	24 04
1½	21 04	25 99	23 79	28 74
2	28 31	34 97	32 01	38 67
2½	44 73	55 28	....	....
3	58 52	72 29	....	....
3½	74 06	90 62	....	....
4	87 75	107 37	....	....

Standard Lapweld Pipe

Per 100 Ft.

	Steel Blk.	Steel Galv.	Gen. Wrought Iron Blk.	Gen. Wrought Iron Galv.
2	$32 01	$ 38 67	$35 71	$42 37
2½	48 26	58 79	54 11	64 64
3	63 11	76 88	70 76	84 53
3½	75 90	92 46	85 10	101 66
4	89 93	107 55	100 83	120 45
4½	1 05	1 29	1 30	1 54
5	1 22	1 50	1 52	1 80
6	1 58	1 95	1 97	2 33
7	2 06	2 53	2 53	3 01
8L	2 16	2 66	2 66	3 16
8	2 49	3 07	3 07	3 64
9	2 98	3 67	3 67	4 36
10L	2 77	3 41	3 41	4 05
10	3 56	4 39	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger, 50%.
4" and under, running thread, 30%.
Standard couplings, 4-in. and under, 30%.
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$10 50	$10 50
Copper, crucible	13 00	12 00
Copper, heavy	12 50	12 00
Copper wire	12 50	12 00
No. 1 machine composition	13 00	12 00
New brass cuttings	7 00	9 00
Red brass turnings	10 00	10 00
Yellow brass turnings	7 00	7 50
Light brass	5 00	5 00
Medium brass	6 50	6 00
Scrap zinc	5 00	5 50
Heavy lead	5 25	5 60
Tea lead	2 50	3 00
Aluminum	16 00	16 00

	Per Ton	Gross
Boiler plate	13 00	12 00
Malleable scrap	20 00	23 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	23 00	25 00
No. 1 machine cast iron	32 00	33 00
Pipe, wrought	9 00	10 00
Car wheel	30 00	33 00
Steel axles	20 00	20 00
Mach. shop turnings	8 00	9 00
Stove plate	25 00	25 00
Cast boring	8 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	+10
Carriage bolts, ⅜-in. and less	Net
Coach and lag screws	—15
Stove bolts	55
Wrought washers	—25
Elevator bolts	+10
Machine bolts, 7-16 and over	+10
Machine bolts, ⅜-in. and less	+10
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 50
Nuts, hex., tapped	add 3 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws —20% 25 and	5
Sq. and hex. hd. cap screws	12½
Rd. and fil. hd. cap screws	plus 25
Flat but. hd. cap screws	plus 50
Fin. and semi-fin. nuts up to 1-in.	12½
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	—5
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	+12½
Studs	+5
Taper pins	—12½
Coupling bolts	+40
Planer head bolts, without fillet, list	+45
Planer head bolts, with fillet, list plus 10 and	+55
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	+60
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add +85
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails, base	$6 10
Cut nails, base	7 00
Miscellaneous wire nails	50%

ROPE AND PACKINGS

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28

POLISHED DRILL ROD

Discount off list, Montreal and Toronto ..... net

STEEL & IRON PRODUCTS

Quality Service

OF EVERY DESCRIPTION

HAMILTON PIG IRON
Basic Malleable Foundry

STEEL AND IRON BARS

OPEN HEARTH STEEL SHEETS

RAILROAD TRACK MATERIAL
Angle Bars Track Bolts Tie Plates Tie Rods Spikes

SCREWS	WIRE	NAILS
Steel	Steel and Brass, Copper and	Wire
Brass	Bronze, Heavy and Fine,	Cut
Bronze	Bright, Annealed, Coppered,	Boat
Wood and	Galvanized, Tinned, Stranded,	Horseshoe
Machine	Steel and Copper Cable,	Shoe Nails
Screws	Barb, Woven Clothes Line	Tacks

POLE LINE HARDWARE
Pole Steps Cross Arm Braces Guy Clamps Guy Rods

WROUGHT PIPE	FORGINGS	LEAD PRODUCTS
Black Pipe	Car Axles	Lead Pipe
Galvanized Pipe	Shape and Drop Forgings	White Lead
Nipples	Carriage and Automobile	Shot
Couplings	Hardware	Putty

BLOOMS
BILLETS
PLOW BEAMS
ANGLES
CHANNELS

THE
STEEL COMPANY
OF
CANADA
LIMITED
HAMILTON MONTREAL

WIRE RODS
HORSE SHOES
FENCING
RIVETS
BURRS

If interested tear out this page and place with letters to be answered.

MISCELLANEOUS

Solder, strictly	$ 29½
Solder, guaranteed	0 31½
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	20 35
Red dry lead, 100-lb. kegs, per cwt.	16 00
Gasoline, per gal., bulk	0 42
Pure turp., single bbls., gal.	3 15
Linseed oil, raw, single bbls.	2 37
Linseed oil, boiled, single bbls.	2 40
Wood alcohol, per gal.	4 00
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S.S. drills, wire size	35
Can. carbon cutters, plus	10
Standard drills, all sizes	35
3-fluted drills, plus	10
Jobbers' and letter sizes	35
Bit stock	40
Ratchet drills	10
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers, carbon	50
Centre reamers	5
Chucking reamers	net
Hand reamers	10
High speed drills, list net to plus	20
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	70	85
Class B	30	40
Class C	20	30

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$10 50	$10 50
Sheets, blue ann., No. 10	9 00	9 00
Canada plates, dull, 52 sheets	13 00	13 00
Can. plates, all bright	14 00	.....
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	13 50	.....
Fleur-de-Lis, 28 B.W.G.	13 00	.....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	12 00
Premier, 10¾-oz.	11 50	12 40
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	35 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	29½
Palacine	32½
Machine oil, per gal.	65
Black oil, per gal.	34
Cylinder oil, Capital	1.01
Petroleum fuel oil, bbls., net	19

BELTING—No 1 OAK TANNED

Extra heavy, single and double	6½
Standard	6½
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	.24
Peerless	.22½
Grand	.22½
Superior	.22½
X L C R	.21
Atlas	.20
X Empire	.19½
Ideal	.19
X Press	.17½

Colored

Lion	.17
Standard	.15
No. 1	.15
Popular	.13
Keen	.11

Wool Packing

Arrow	.35
Axle	.28
Anvil	.22
Anchor	.17

Washed Wipers

Select White	.20
Mixed colored	.10
Dark colored	.09

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$37 50	$37 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	44 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	47 00	46 00
Copper sheet, planished, 16 oz. base	51 00	50 00
Braziers', in sheets, 6 x 4 base	43 00	42 00

LEAD SHEETS

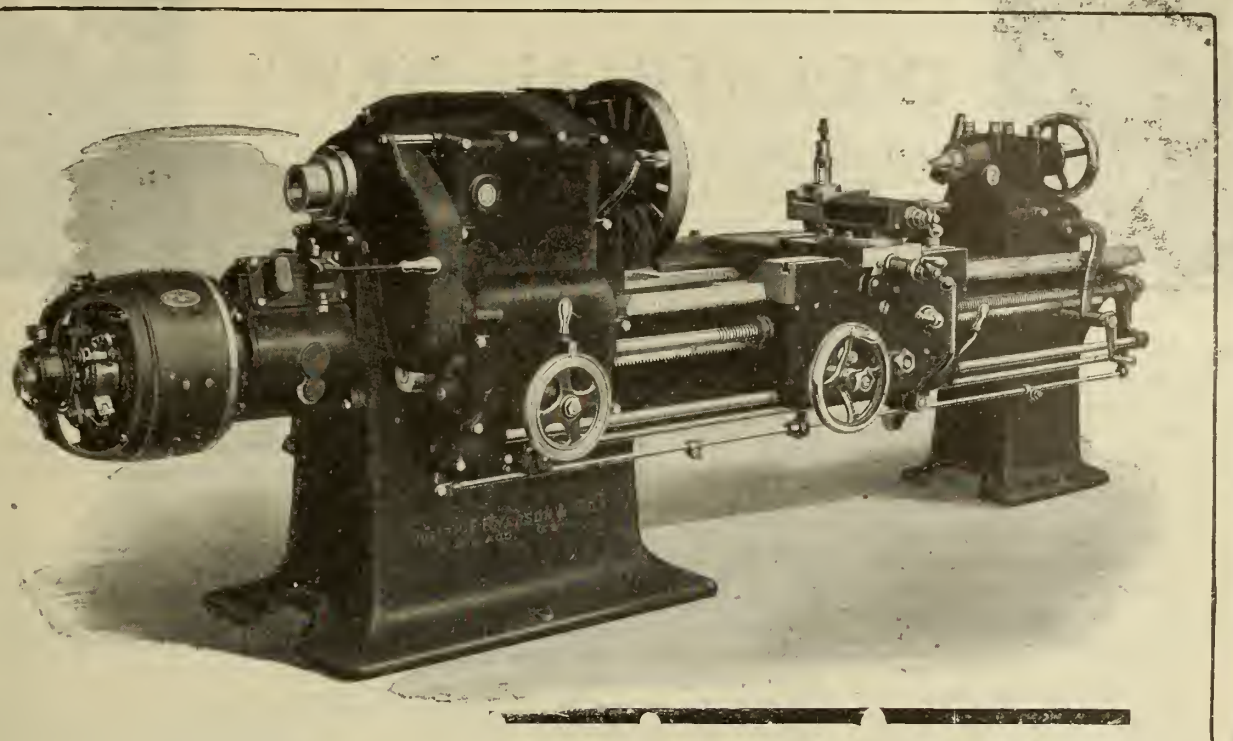
	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$11 50	$14 50
Sheets, 3½ lbs. sq. ft.	11 25	14 00
Sheets, 4 to 6 lbs. sq. ft.	11 00	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.04¾
Acid, nitric	.11
Acid, sulphuric	.04½
Ammonia, aqua	.15¾
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.16
Copper, carbonate, annhy	.41
Copper, sulphate	.13
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.20
Nickel carbonate	.32
Nickel sulphate	.20
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lbs	9.00
Sodium phosphate	.15
Tin chloride	.30
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated



Ryerson-Conradson Lathes

U.S. and Foreign Patents

Ryerson-Conradson Machine Tools

LATHES
RADIAL DRILLS
MILLING MACHINES
PLANERS

The Ryerson-Conradson High Power Precision Selective Head Lathes are the result of long and thorough study of lathe requirements.

They have been taken out of the old time class of machine tools. They are designed and built for accurate, quantity production.

Ryerson-Conradson Lathes are superior to all modern lathes—and we can prove it. The new features will surprise you.

Write for Bulletin No. 1301

JOSEPH T. RYERSON & SON

CHICAGO, ILL., U.S.A.

Canadian Representatives: MACHINERY

GARLOCK-WALKER MACHINERY CO., 32-34 Front Street West, TORONTO

MONTREAL WINNIPEG

If interested tear out this page and place with letters to be answered.



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES



Building in Galt.—The local commission of the Hydro have decided to erect a fine modern public utilities building at the corner of Dickson and Wellington streets, Galt. They expect to proceed with the work during the coming year.

New Coking Plant.—It is reported that the United Gas and Fuel Co. intend commencing the erection of a three-million-dollar coke oven gas plant in the northeast end of the city of Hamilton.

New Library.—Plans are under way for the beginning of the new Carnegie library at Lethbridge, with the promise of $25,000 made by the Carnegie Foundation for this purpose. It will consist of a daylight basement and one storey above it.

Call for Tenders.—Plans are nearing completion and it is expected that tenders will be called for during the winter for the addition to the Ritz Carlton Hotel, Montreal. The addition will add 150 rooms, will be nine or ten storeys in height, and cost about $750,000.

May Build Hotel.—An unofficial report has spread about that tentative plans are entertained by the Canadian National Railways to erect a hotel in Quebec along the lines of the Chateau Laurier, Ottawa.

Steel Contract.—The Hydro Electric Power Commission of Ontario has awarded the Dominion Bridge Co., Ltd., the contract for five large penstocks for its Queens plant. The contract calls for early erection, as part of the plant must be in operation by September next year. Over 2,000 tons of steel are involved in the contract.

New Molding Shop.—A new molding shop is being started at Kingston, Ontario, by Messrs. Kelly and Driver. It has been stated that the ratepayers will be asked to give the company a free site on Montreal St., at a cost of $2,000, and exemption from taxes for ten years.

Large Building.—Although the actual construction work will not start till next spring, preliminary surveys are being made of the grounds along the Trent Road on which the new Albert College is to be erected at Belleville. Chapman, Oxley & Bishop are the architects, and Mr. Oxley is the engineer. It is expected that an outlay of a million dollars will be necessary.

GIFT TO ASSIST HOSPITAL WORK

H. W. Petrie Remembers the Hospital In the City Where He First Started Business

H. W. Petrie, president of the H. W. Petrie Co., Ltd., Toronto, has remembered his old city, Brantford, where he first started in business. The remembrance has taken the form of the setting aside for a term of five years of $25,000 Victory bonds, the interest to be paid half yearly to the hospital. In his letter to C. H. Waterous, president of the Brantford General Hospital, Mr.



H. W. PETRIE

Petrie pointed out that his "first business venture took place in Brantford, of which for many years I was a citizen, and, despite my removal some thirty years ago to Toronto, the interests and developments of the place have always been very dear to me. In this regard I shall deem it a privilege to do something on behalf of your splendid public institution."

C. H. Waterous, in accepting the gift, stated: "Your citizenship here is still recalled with pleasure and profit by many old friends, who take pride in the success which has so worthily crowned your business enterprise and integrity, and who deeply appreciate that in the days of your well-earned prosperity you have decided to remember in so tangible a manner the place and the people associated with your early life and commercial efforts."

The Brantford "Expositor," commenting editorially on this, remarks: "The hospital board has not received much encouragement of this kind in its labors, and the generous action of Mr. Petrie is consequently greatly appreciated by them. It is hoped also that it will prove an example to others."

DRAWN STEEL PLANT IS BUSY

Hamilton.—Speaking of the steel industry in general, S. J. Waddie, president of the Canadian Drawn Steel Company, stated that its immediate future was not likely to be affected to anything like the same degree as other lines of industry might be.

As for the company he is associated with, Mr. Waddie said there were sufficient orders on hand to insure uninterrupted operations for a long time to come. Retrenchment was something his company had had no occasion to consider so far. All employees were at work and the plant was operating at full capacity. The greater part of its production was for the domestic market.

"We could get much more work to do if we could only get the raw material," observed Mr. Waddie, "but we experience the greatest difficulty in this connection, with the result that our export market has been crippled somewhat."

Use Northern Rock.—The Silica Granite Products Company, Ltd., is a company formed under Ontario charter, having headquarters in Hamilton, Ont., president, A. R. C. Smith, secretary-treasurer, A. Caddie. The company's property is situated in the township of Henwood, New Ontario, and consists of 160 acres, whereon is a very extensive formation of granite rock. This rock, when quarried and crushed to various sizes is a base for cleansers of various kinds, such as dry and wet hand cleaners, household cleaners, etc. A medium size of the rock is found to be exceptionally good for foundry use in sand blasting of castings. The rock is used for monumental work, is similar in color and hardness to Scotch granite. There are in all, at present, twenty-one known uses for this product, which assures it an extensive market. Installation of machinery is almost completed, and the company expect to ship about December 1, 1920.

The Week's Events in Montreal Industry

Industrial incorporations for the past week include the Forged Steel Specialties Company of Montreal, $500,000, and the Canadian Piston Ring Company of Montreal, capitalized at $75,000.

Hodgson Freck, Ltd., of 369 St. James Street, Montreal, foundry, mill and metal merchants, have secured the Eastern Canadian agency for Robert Drury of Canada, Ltd., of Toronto, manufacturers of hardwoods and veneers.

At the November meeting of the Canadian Railway Club, in Montreal, a paper on "How to heat railway buildings economically" was read by R. H. Black, engineer of power plant construction of the Grand Trunk Railway Company. A large gathering of the members was present and the discussion following the reading of the paper indicated the great interest that was taken in this subject.

Malcolm Lemieux has recently purchased large interests in Motor Car Distributors, Ltd., and has been elected a director and appointed general manager of the entire concern. He has secured district agencies for all of Eastern Canada for Peerless and Chandler cars, and Beaver Hall, the new four-storey spacious building on Beaver Hall Hill, Montreal, has been acquired for offices and warerooms. Mr. Lemieux has spent his entire lifetime in the automobile business.

The Armstrong Whitworth Company of Canada are entering on a new line of activity in the shape of marketing an English make of automobile manufactured by the Armstrong Siddeley Company of Coventry, England. Every part of this car, even to the tires, is made by the Armstrong Siddeley Company. This car is of exceptionally high grade quality and is designed especially for the convenience of the owner-driver, simplicity of operation being an important feature. In design it is entirely original, and embodies experience gained during the past four years. This is particularly true of the six-cylinder engine, which is that known as the Deasy aircraft engine. These cars will sell at $8,500 and $11,000.

MACHINE TOOLS CANNOT COME BACK TO LOW PRE-WAR LEVELS

"HOW about prices? Well, for the life of me I can't see where there is any great cut coming, and I don't think it is well that we should do anything to lead the buyers to believe that such will be the case for the present at least."

That is the way the manager of a firm of machine tool dealers sized up the situation for Canadian Machinery.

"For a long time," he continued, "there have been makers of machine tools that have never made much money. They have never had enough margin to allow them to go ahead and develop as they should develop. They have never been able to afford a research department or do the experimental work they should. The machinist, too, for years, was a low paid man when compared to the outside trades, in many of which there was not nearly the skill required that the machinist needs in his work. I can look back over my own experience, and can remember our shop giving prices for building a lathe. Very often the completed machine would represent the cost of actual production, and the usual profit, but there would be nothing allowed for the number of castings that were poured and broken up as being not good enough.

"Now, here is a line that will show how prices compare with the old days. As a rule 1914 is taken because it was in that year the war started, and everything dates from before or since the war. But figures I am giving are for 1910 and 1911. In 1910 a chucking and turning machine cost $1,200, and the present price is $2,010. Here is another style of the same machine, a little larger. In 1911 the price was $1,500 against a quotation today of $2,405. Then here is the 15-inch shaper that in June of 1911 would have sold for $390, and today is listed at $875. A 24-inch shaper that in 1911 brought $595 is today selling at $1,195. That is, as far as I can learn, about the rate of increase that has been made by the standard builders of the country. It is not out of keeping with the way in which everything has increased. Pig iron and steel have increased more than that. Not only has the price of the tool increased, but one must not forget that the standard and quality of the output has increased. We are making a better machine today than we were before. There are more attachments on it for good work. There may be reductions made, and I do not hold that they would not be desirable, but it would be a mistake to imagine that business is going to come back to the same poor level it had before the war. I can't see where it is desirable from any point of view, or where it would be to the lasting advantage of any person."

MANY REPLIES FROM CONTEST

Readers Are Showing a Keen Interest in Perusing Advertising Pages

A large number of answers have been received to the contest conducted by Canadian Machinery regarding the contents of the advertising pages, and the rules offered as prizes will be sent out in a few days.

A more comprehensive list is being prepared and will appear in the next issue of Canadian Machinery. Watch for it.

THE YEAR'S WORK AT SCOTIA MINES

Increase in Production Found in Comparing With Last Year's Figures

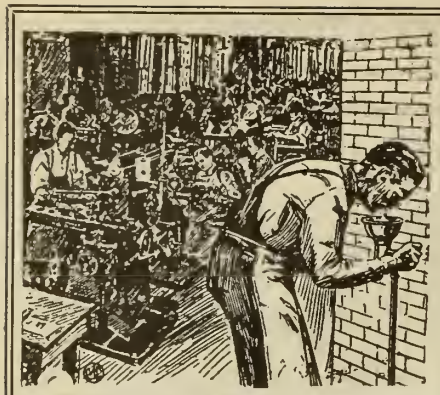
If increase in production is a dependable criterion, the earnings of the Nova Scotia Steel & Coal Company for the 1920 year will show a big gain over last year. Due to adverse market conditions the 1919 production fell off sharply as compared with the two previous years. That there has been an equally decisive recovery is indicated by the following figures (in tons):

	Nine months to Sept. 30.	
	1920	1919
Coal	456,312	387,151
Pig iron	63,632	26,697
Ingots	95,354	38,306
Blooms and billets	82,202	36,124
Merchant mills	44,859	27,864

Nova Scotia Steel last year on greatly curtailed output earned $5.73 a share for the $15,000,000 common stock, as against $5 paid in dividends. On this small number of common shares (150,000) the company this year is undoubtedly making a much more satisfactory showing, thus confirming the conviction of leading shareholders that their property is one of the most valuable participants in the pending British Empire Steel merger.

The city of St. Johns, Nfd., is to have a new 200-room hotel, costing $1,000,000, to be operated by the United Hotels Co. The capital invested is to be local capital.

A new garage is to be erected by the Consolidated Motors, Ltd., at Winnipeg, at a cost of $80,000.



A Drinking Water Service that will last a LIFETIME

What you pay for a few ordinary drinking cups will meet the cost of the

PURO SANITARY DRINKING FOUNTAIN

(MADE IN CANADA)

DRINKING CUPS ARE UNSANITARY but the "Puro" delivers clean, fresh water at a reduction of 15 per cent. to 35 per cent. in water bill.
"PURO" WILL SAFEGUARD THE HEALTH OF YOUR EMPLOYEES and protect your staff against disorganization by sickness.
Easily attached. Simply unscrew the ordinary faucet and put on the "Puro."
Write us to-day for full information regarding the cost of installation of the "PURO" Sanitary Drinking Fountain Service.

Puro Sanitary Drinking Fountain Co.,

Canadian Agents:
McKENZIE BROS.
888 F. St. Andre St., Montreal, P.Q., Canada



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In all countries. Ask for our Investor's Advisers which will be sent free.

MARION & MARION 364 University St.

Merchants Bank Building, corner St. Catherine St., Montreal, Phone Up. 647, and Washington, D.C., U.S.A.

MOTORS AND CORRECT APPLICATION

Continued from Page 465

tions that may be made in the motor by control of its design. Both of these points should be thoroughly understood and analyzed, before a proper motor application can be made.

Figure 1 herewith, shows the speed-torque characteristics of a standard polyphase induction motor. The upper one of the three curves shown is the speed-torque curve of a typical standard induction motor. In these curves, synchronous speed is taken as 100%, and the maximum torque that the motor will develop is also taken as 100%. The full-load torque—that is, the torque at which it will operate continuously without overheating—is only about 30% of the maximum torque. It will be noted that the full-load torque occurs when the speed has dropped to about 96% of the synchronous speed; that is, the slip is about 4%. If over-loads are applied, the speed continues to drop and the torque to rise, until the torque has risen to a value of a little more than three times that at full-load, and the speed has dropped to about 75% of the synchronous. Then occurs the so-called "pull out" point; that is, an attempt to pull still more load with torque causes the motor rapidly to come to a standstill because beyond that point the torque decreases rapidly with decrease in speed. This is accompanied by a rapid increase in current as is shown by Figure 3. This "standard motor" is provided with a low resistance motor and is the type of motor that is usually referred to as "standard."

If instead of a low resistance rotor, one is provided with approximately double the resistance of the "standard," the middle curve of Fig. 1 will apply. The speed-torque curve of the motor will be distinctly modified by this change in resistance. The slip for a given torque is much greater than in the "standard" motor. Instead of 4% slip with full-load torque, we now have nearly 10%. The "pull out" instead of occurring at about 75% syncronous speed, now occurs at about 30% synchronous speed. Also, the torque at standstill is nearly a maximum, and the current taken at standstill, as shown in Fig. 3, is considerably less than with the standard motor. In comparing these two curves, it is quite obvious that for work that requires large motor torques at speeds lying between approximately one-third and two-thirds of the synchronous speed, the motor with the middle curve is better adapted than the "standard motor." Also, for "fly-wheel" jobs—that is, where a fly-wheel does the work, and it is the duty of the motor to bring the fly-wheel up to speed again at its leisure, the middle curve is obviously the better, since it allows the fly-wheel to give up more than double the energy without bringing the motor to a given load, than in the case of a "standard" motor. For hoist work also, where heavy torques are necessary at start and the loss of a small fraction of speed under load is immaterial, experience has demonstrated that this type of curve is highly desirable.

If the resistance of the rotor is still further increased; that is, approximately doubled again, the lower curve of Fig. 1 applies. In this case it will be seen that the slip is still further increased, being about 18% at full-load torque, and that at standstill the torque is still increasing; that is, the "pull out" point is at some negative speed. This type of motor is applicable to cases where the maximum torques are required at standstill and at speeds up to 40% or 50% of synchronous. The elevator is a typical example of this duty. In this duty, the maximum torque is required at standstill since the friction of rest must be overcome at this point and, as is well known, the friction of rest in the typical elevator engine is several times that after the first few revolutions. The overcoming of this friction of rest and the acceleration of the car from standstill requires the maximum torque at low speeds in this application, and experience as well as theory has shown that this curve is best adapted for elevator work.

By using o Slip Ring motor the rotor resistance may be changed at will, and a motor of this type may be changed at will to meet any of the speed-torque characteristics shown in Fig. 1. In securing this advantage, however, we have been obliged to use slip rings on the rotor, thereby increasing the cost and reducing the reliability and ruggedness of the machine, but more important, we have very considerably reduced the maximum torque which the motor will produce. These disadvantages make it highly desirable to stick to the Squirrel Cage construction, if it is in any way possible, to fit any single speed-torque characteristic shown in Fig. 1 to the work to be performed.

Fig. 2 shows how the horsepower output of the three motors shown in Fig. 1 varies with torque. In considering these curves, we should bear in mind that the main part of the work done by the low resistance and semi-high resistance rotors are preferably close to the synchronous speeds, while the design of the high resistance rotor is such that it can do its best work at speeds below 50% of synchronous.

Fig. 3 shows how the amperes and power factor of these motors cary with torque. For a given torque, the amperes and power factor of any of the three motors is exactly the same.

However, the maximum amperes of the high resistance rotor machine at standstill is only about two-thirds of that of the low resistance rotor. The much higher torque of the high resistance rotor machine gives us at standstill a torque per ampere about three times as great in the high resistance rotor machine as in the low resistance rotor.

Scrap Metal Market

There is no life in the scrap metal market. Prices are continuing to lower in practically all grades and demand is almost wholly lacking. Owing to the inactivity of the Chicago market for iron and steel scrap with the demand for their products diminishing, consumers of scrap see no incentive to buy further supplies, and are using their reserves instead.

Neither sellers nor buyers apparently care to do business in cast grades on the Boston market. No. 1 machinery selling at $41, delivered, and resale pig iron available at $45, delivered, foundrymen are adopting the policy of reducing the scrap proportion in their melts.

Prices are nominally unchanged on the New York market, but the local iron and steel market appears weaker. Supplies are accumulating steadily and prospects of early activity are still remote.

Prices are still lowering and there is very little buying in the Philadelphia district. It is believed, however, that present prices are near the bottom and buying of any size would bring advances.

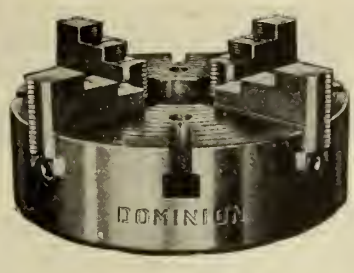
The Pittsburgh market for iron and steel scrap continues dull and practically no interest is being shown by consumers. Quotations are largely nominal. The market still continues low at Buffalo and mills generally are not interested. Though some small sales are reported there is no active demand. Some inquiries from eastern Pennsylvania for machine shop turnings and cast iron borings created a little interest.

Iron and steel scrap prices are firmly maintained even in the face of continued light buying and no future inquiry. The belief of sellers is, that there will be a revival of buying after the first of the year because of the limited yard stocks of consumers, and are refusing to make concessions.

At Cleveland the heaviest movement of iron and steel scrap seen in months is featured. This is the result of an effort by the dealers to cover contracts many of which are of long standing. Heavy melting steel has fallen from $24.25 to $24.75 to a range of $22 to $23.

No improvement is noticed in the southern iron and steel scrap markt, but dealers have confidence as to future prospects.

Considerable resale iron is coming into the market at St. Louis, some offered as low as $38 for No. 2 southern (1.75 to 2.25 silicon). The recent slump in scrap iron prices has cut down the demand for all grades of pig iron.



DOMINION CHUCKS

STEEL OR CAST-IRON BODY
BUILT FOR HEAVY DUTY



The Jaws Are Extra Strong

THEY are drop forgings, made of best quality steel, heat-treated and hardened. The threaded portion of jaws form a half nut for the setting-up screws. Have stood the test of heavy duty work in our own shops where accuracy was the only accepted standard.

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LIMITED
Engineers • Manufacturers
BRANTFORD, CANADA

3

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BERTRAMS LIMITED
SCIENNES EDINBURGH

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The old established firm. Patents everywhere. Head office, Royal Bank Bldg., Toronto. Ottawa office, 5 Elgin St. Offices throughout Canada.
Booklet Free.

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OVENS
Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.
Brantford Oven & Rack Co. Ltd.
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BLACK DIAMOND OVENS

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Send us your blueprints and specifications. Entrust your requirements to experienced workmen and up-to-date equipment. Have your dies made in Canada. First-class workmanship guaranteed.
THE KIMBER & HILLIER MFG. CO.,
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ALEMITE LUBRICATING
EQUIPMENT
TORONTO

MACHINE AND BENCH VISES
Write for Prices
Superior Machinery Co., London, Canada

HAMILTON ENGINEERING SERVICE
LIMITED
Consulting and Designing
Tools, Jigs, Fixtures and Special Machinery. Let us shoulder your problems.
17 MAIN ST. EAST, HAMILTON

Classified Opportunities

AGENCY OPPORTUNITIES

WE ARE FREQUENTLY ASKED TO SECURE representatives for manufacturers in Canada, Great Britain and the United States. From time to time we shall publish particulars regarding agencies available and correspondence is invited. If the information has not been previously supplied please give particulars regarding experience, sales organization, territory, etc.

MANUFACTURER OF SAND MIXERS WISHes to secure aggressive representation in Canada. Box 733A, Canadian Machinery.

AMERICAN MANUFACTURER OF SANITARY drinking fountains who has made arrangements to have his line manufactured in Canada wishes to get in touch with a man who can sell the appliance in industrial plants of all kinds. Box 730A, Canadian Machinery.

HIGH SPEED STEEL MANUFACTURER wants Canadian representation. Box 732A, Canadian Machinery.

AMERICAN MANUFACTURER OF CORE compounds, etc., wants Canadian agency connection. Box 731A, Canadian Machinery.

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W. H. Sumbling Machinery Co., Toronto. (ctfm)

FOR SALE

BELTING—4½-4 PLY NEW CANVAS STITCHed belting at 30 cents per foot. We carry a complete stock of belting, pulleys and mill supplies, N. Smith, 138 York St. (cfm)

ONE 5 H.P. JONES & MOORE, 1440 R.P.M. motor, and one 10 H.P. Canadian General Electric Company's 1500 R.P.M. motor. Both for 25 cycle, 550 volt, 3 phase current; 10 H.P. motor equipped with standard oil-immersed starter with no voltage release attachment. Both in good condition and may be had at a reasonable figure. Mathews Gravity Carrier Company, Limited, Port Hope, Ontario. (c22m)

FOR SALE—ONE BURY AIR COMPRESSOR, 12 x 14, Class M, 330 cub. ft. per minute, belt driven, only slightly used, $750; one air compressor tank 42 in. x 8 ft., man-hole on top, two 4½ in. side openings and one 2 in. side opening, $100. Taylor-Forbes Co., Ltd., Guelph, Ont. (c23m)

PATENTS

PLEASE TAKE NOTICE THAT THE UNDERsigned attorneys for the patentee are prepared to supply at a reasonable price any demand for anti-creeping devices for railway tracks as described in Canadian Patent 186389, granted Sept. 3rd, 1918, to D. M. Patrick. They are also prepared to receive offers for the purchase of the patent or for licenses to operate under the same. Ridout & Maybee, Kent Bldg., Toronto, Canada.

PLANT WANTED

ENGINEERING WORKS WANTED—PREFERably in Ontario, to produce grading, excavating, road-building machinery. Advertiser will provide designs, patterns, etc., and is prepared to make contract immediately with suitably equipped firm. Replies should be in detail necessary to determine suitability of plant, location and the extent and nature of present manufacturing operations. Principals only dealt with. Box 710, Canadian Machinery. (c21m)

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BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

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FOR HIGH-GRADE AMERICAN-MADE LATHE —14 to 26. In replying state territory you can cover and cover thoroughly. Box 682, Canadian Machinery.

CANADIAN MACHINE SHOP

Will handle medium Specialty Line — Manufacturing and Selling

Apply Quickly
Box No. 715F
CANADIAN MACHINERY

HARDWARE AT REDUCED PRICES.
VALVES
PIPE & RAILING FITTINGS
IRON BARS
MACHINE BOLTS
BABBITT.

WRITE FOR LISTS.

Port Arthur Shipbuilding Co.
PORT ARTHUR, ONT.
(C22M)

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Canadian Machinery
Classified Advertising Section
143-153 University Avenue
TORONTO

Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

FOR SALE
USED MACHINERY
IN A 1 CONDITION

1—16" Hendey Shaper.
2—18" x 8' Mueller Lathes.
1—18" x 8' Cincinnati Lathes.
1—26" x 12' C.M.C. Lathe.
1—24" x 10' Milwaukee Lathe.
1—32" x 24' Engine Lathe.
2—3 x 36 J. & L. Turret Lathes.

We are offering the above machines at very attractive prices. Write us for quotations on your requirements.

CHARLES P. ARCHIBALD & CO.
Machinery and Supplies
285 BEAVER HALL HILL, MONTREAL

Agent Wanted

Wanted, a jobber to represent, in Eastern Canada, an American manufacturer of well-known and advertised line of Oxy-Acetylene Welding and Cutting apparatus. Terms very favorable.

Box 705F
CANADIAN MACHINERY

Classified Opportunities

USED MACHINERY FOR SALE AT BARGAIN PRICES

1—Weighted Tension Band Saw.
1—No. E-3 Keller Automatic Die Sinking Machine. Complete with Cutter Grinder, Motors and other necessary equipment.
1—Allis-Chalmers-Bullock 300 H.P. Induction Type, 2200 volts, 3-phase, 60-cycle, 430 R.P.M., complete with Pulleys, Bed Rails, Ratchets and Starter.
1—30 H.P. Crocker-Wheeler Induction Type Motor. Size 120-Q., 750 R.P.M., 25-cycle, 3-phase, 550 volts. Complete with Base, Pulley and Starter.
1—No. 4146-2 Brown & Sharpe Cutter Grinder, less Counter-Shaft.
1—Yankee Drill Grinder.
1—Whitney Hand Miller, with Counter-Shaft.
2—Large Sturtevant Heating or Ventilating Fans.
2—Small size Sturtevant Mill Exhausters.
8—Root Blowers of various sizes.
1—Northway Pressure Steam Pump.
1—20" Aurora Upright Drill Press.
3—15" Engine Lathes, 6 ft. Bed.
1—No. 7 Long and Allstatter Double End combined Power and Punch Shear.

And miscellaneous number of Pulleys from 48" diameter to 6" diameter in Wood Split, Steel Split, Cast Iron, Split and Solid Cast Iron Pulleys.

For prices and further information on above refer to

GENERAL FORGINGS & STAMPINGS LIMITED

Merritton **Ontario**

Machine Shop Equipment For Sale

At Extremely Low Prices

PLANER—22½" x 22½" x 6' Gray Planer, in very good condition.
SHAPER—16" Back Geared Steptoe, overhauled.
LATHES—Special price quoted on rebuilt 20" x 8' C.M.C. Lathes.
Also full line including:
C.M.C., Giddings & Lewis, Milwaukee, Barber, Preston, 18" x 8' beds.
Condition equal to new.
AIR COMPRESSOR—8" x 8" Chicago Pneumatic, in condition equal to new.
DRILL PRESSES—2 Avery Drills, No. ½.
TANKS—10 Tanks 10' 6" diam. x 29' 6" long. 19,000 gals. capacity.
3 Tanks, 10' 0" diam. x 39' 0" long, ⅜" Heads, 22,893 gals.
2 Tanks, 9' 0" diam. x 40' 0" long, ⅜" Heads, 20,080 gals.
Full line of other Steel Storage Tanks, open and closed, all sizes
PUMPS—1—Triplex Power Pump, 1½" x 6" Hydraulic Machy Co.
1—Sheldon Rotary, 1½" x 1¼".
1—Centrifugal Pump, 2½" x 1½" Gould
1—Gould Triplex Power Pump, 2" x 3".
2—Darling Horizontal Triplex, 1½" x 4".
1—Gould Triplex Pump, 3½" x 4".
Full line small centrifugal pumps, belt drive.
OIL—150 Barrels Sperm Oil.
150 Barrels Lardene Oil.—Bargain for quick sale.

Standard Equipment & Tool Works
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INTERNATIONAL MACHINERY & SUPPLY COMPANY LTD

Gaskets of all kinds and sizes.
Packing of every description.
Engine Room Equipment.
Wire, Hemp and Manila Ropes and Cables.
Paints and Varnishes for every purpose.
Motors and Motor Generators.
Electric Cable.
Complete line of finished and semi-finished Wrenches.
Screw Jacks.
Culver Ball Bearing Jacks, 20-ton to 100-ton capacity.
Brass Castings of every form, shape and description—finished and unfinished.
Pneumatic Tools backed by a guarantee that the efficient shopman cannot overlook.
Valves, Globe, Angle and Gate.
Monkey Wrenches.
Hammers.
Bearing Metals of every description.
Warehouse Trucks.
Taps, Dies, Drills, Reamers and Winches.
Goggles, Industrial and Welding Boiler Grates.
Nathan Locomotive Devices.
Paxton-Mitchell Metallic Packing.

International

Supplies For Railway, Marine and Industrial Purposes

The list of machines, instruments and supplies shown here is only partial.

If what you want is not here, write us. We'll have it.

We have been specializing in Railway, Marine and Industrial Supplies for many years and have an efficient, well-organized staff which is ready to give your orders prompt and careful attention.

Write, Phone or Wire Your Orders!

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Nothing to Beat These At Our Prices

5 ft. Prentice Plain Radial Drill.
3 ft. Morris Plain Radial Drill.
26 in. x 12 ft. McDougall Engine Lathe.
20 in. x 8 ft. American Engine Lathe.
No. 1 Norton Tool and Cutter Grinder.
18 in. x 8 ft. Engine Lathes.
14 in. x 6 ft. Engine Lathe (new).
22 in x 22 in. x 6 ft. Gray Planer.

All in fine condition.

The Blashill Wire Machinery Co.
Limited
307 St. James St.
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For a high grade Piston Packing amongst mill and steamer supply houses in all the principal centres. Sold at a reasonable price, allowing for a good margin of profit to the dealer.

Write for our agent's proposition

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Office and Warehouse:
136-140 Upper Water St.
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are certainly no better, and usually not so good as the domestic product. In the long run you will find it more profitable to use the dependable

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"They Cut Faster and Wear Longer."

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INGERSOLL FILE COMPANY LIMITED,
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Springs *for* Every Use

We have been making springs of all kinds for 70 years. Let us advise you when in difficulty.



Tell us the purpose for which the spring is intended, and experts will gladly co-operate to see that you get the design best suited to the purpose.

Dunbar Springs are thoroughly tested for accuracy and quality. Send us specifications, for estimates.

THE DUNBAR BROS. CO.
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Spencer's "Crescent" & "Velos" Steels

for Canada again:

During the war, with its abnormal demand, "Velos," "Crescent" and the other famous steels made by Walter Spencer & Co., Ltd., in Sheffield, England, were not available in Canada. Now we have arranged to stock and distribute them so that you can have the advantages which come from using these reliable steels:

Spencer's "Crescent" Mining Drill Steel

Solid and Hollow, Hexagon or Round —for mining, excavating and track tools and chisels. Known and preferred throughout the British Empire.

Spencer's Mining Tool Steels:

Extra Special Triple Crescent

A special alloy steel which does not shrink in hardening. For dies, taps, reamers, punches, cams, bearings and similar service.

Special Diamond Cast

An exceptionally tough steel, especially suitable for battering tools—hammers, dies, rivet snaps, chisels and caulking tools.

Special Ardho

An oil-hardening steel which requires no tempering. Easier to forge, harden or weld than any other known steel. No danger of overheating. Especially suitable for tools to withstand shocks.

Crescent Cast

Spencer's standard tool steel. Used successfully for every tool and machine shop service which is within the capacity of carbon steel.

Spencer's High Speed Tool Steels:

Triple Velos

A 25% Tungsten steel for exceptionally severe service; for machining such tough materials as locomotive tires, chilled rolls, manganese and chilled steel and iron castings.

Velos U R (18 p.c. Tungsten)

A quality steel for any work in a machine shop, or for any tool. The steel to use for quantity production at low cost, in almost any grade of steel or iron.

Spencer's Nickel-Chrome Steels for Auto and Machine Parts:

S. N. C. 1 and 2—Nickel-Chrome, oil-hardening, for axles, driving and crank shafts, connecting rods and gears.

S. N. C. 3—Nickel-Chrome, air-hardening, for gears, axle shafts and parts subject to severe torsional stress.

S. N. C. H.—Nickel-Chrome, case-hardening, for parts requiring exceptional strength and surface hardness.

The thoroughly dependable quality of Spencer's steels has long been established and prices are very favorable indeed. Give us an opportunity to quote on your requirements.

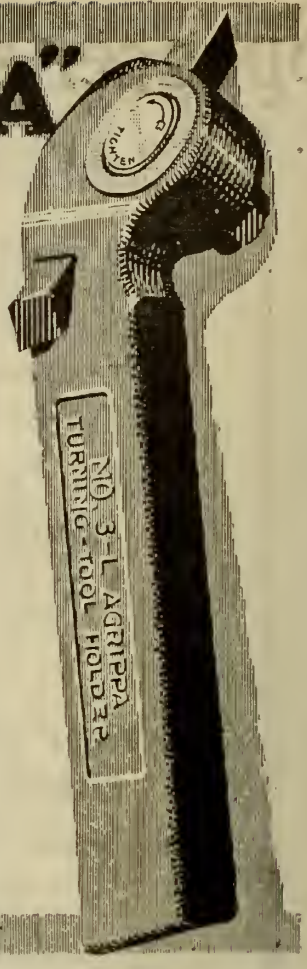
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THE production of superior drop-forged tools is traditional in our works. For nearly half a century our entire energy, equipment and resources have been devoted, wholly and exclusively, to the manufacture of the highest grade of product made possible by the development of the drop-forging art.

Like all of our *standard* Machinists' Tools, Williams' "Agrippa" Tool Holders are built for service—severe service that tries stamina to the utmost. Drop-forged from a special grade of carefully selected steel — scientifically heat-treated and hardened — they are sturdy, dependable tools of proven strength and merit.

A wide range of sizes in standard patterns for all regular machining operations: Turning, Boring, Planing, Threading, Knurling, Cutting-off and Side Work.

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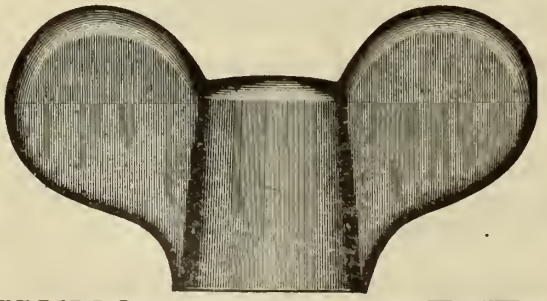
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"The Drop-Forging People"

Formerly the Canadian Works of The Whitman & Barnes Mfg. Co., St. Catharines, Ontario

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DROP FORGED STEEL



WING NUTS **EYE NUTS**

All Sizes

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Imperial Genuine

Made for extra heavy duty, such as Main Bearings on Turbine Generators, Calender Rolls in Pulp Mills, is specially adapted for Marine Engines.



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THE BABBITT METAL WITHOUT A FAULT

For Donkey Engines, Saw Carriages, Small Motors, Transmission Line Shafting and all steady heavy pressure duty.



Matchless

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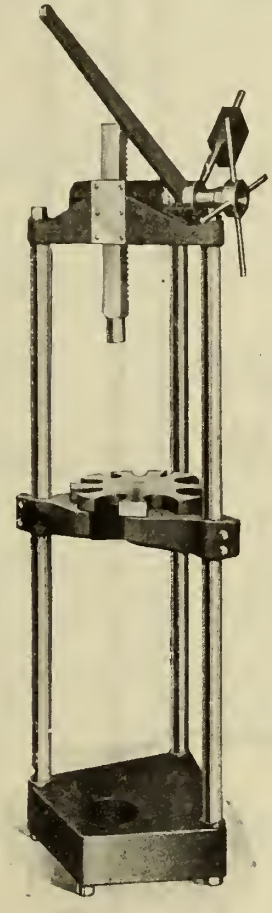
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The NECO ARBOR PRESS

The Powerful "three point" construction permits the maximum of strain with perfect alignment.

The Ratchet Feed with the long leverage giving unexcelled power, together with the automatic release, obtains easy and efficient operation.

Capacity, 3 tons
Clearance, 16 inches
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The Adjustable Table and 36-inch range give it an unusual capacity for service.

Its design and construction are up to the standards and advancement of all "NECO" production where Merit and Service are paramount.

Openings in dial for nine sizes of arbors up to 3½ inches.

Patents Pending

We do not put all the strain on one tooth of the ratchet—We put the strain on all the teeth all the time.

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meets the requirements of the most exacting shop practice where efficiency and production count. Its sturdy, rigid construction and wide range of productive capacity are appreciated by users who know and want practical appliances. It is one of the most useful units of modern shop equipment. Just the thing for the Auto Repair Shop. Price $125.00.

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L-XX
HIGH SPEED STEEL

CARBON TOOL STEELS
ALLOY STEELS

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LIMITED

General Sales Office: 133 Eastern Ave., TORONTO, ONT.

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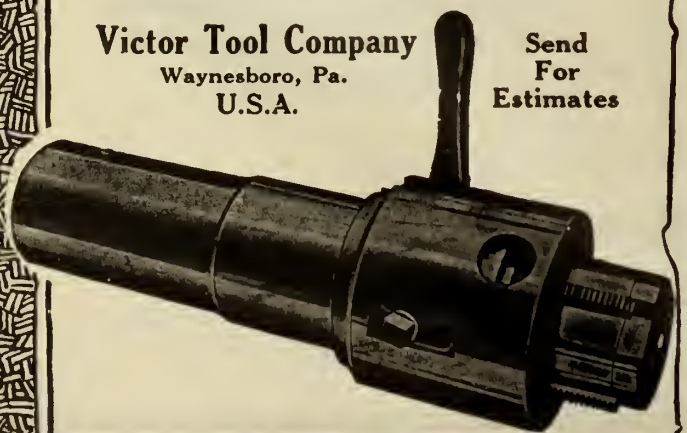
We wanted something original—this is what we got

"BOTH of these operations and half another — I'll show you later—completed in the time our old taps took to do one; that, I guess, is why we continue to use your Victor Collapsible Taps."

It was the often-heard story of time saved, of costs lowered, of all threads clean and smooth. And it was pleasant to hear.

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Waynesboro, Pa.
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Test Dominion Wheels Against the Best Imported Quality

If you have been skeptical of the merit of Canadian-made grinding wheels in the past, do not let that prevent you from giving Dominion wheels an opportunity of proving their superiority.

Since we have commenced making Dominion wheels from our own abrasives, their uniform quality is rapidly removing the stigma from Canadian wheels throughout the whole country. Give them their chance with you.

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WE CAN SUPPLY

STEEL PLATE

—IN—

Universal Edge - up to 40 in. wide

Sheared Edge - up to 60 in. wide

Any Thickness **Any Lengths**

Send Us Your Enquiries.

Dominion Foundries & Steel, Limited

HAMILTON, ONTARIO

Free Tool Grinding Chart

Grind your cutting tools in exactly the right way to get best results—and you save time. That's obvious. It is precisely that that this Tool Grinding Chart enables you to do.

It has been adopted as standard by many firms that found it a long way better than guess work.

CANADIAN MACHINERY would like to see this Chart in every shop in the Dominion. Mail the coupon below for your copy to-day.

Shows at a glance Correct Clearance and Rake Angles for Cutting Tools

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CANADIAN MACHINERY,
153 University Avenue, Toronto.

Please send me / us free, one of your tool grinding charts.

Signed .....

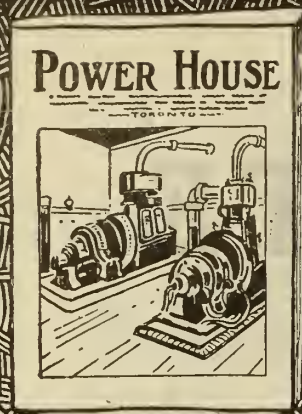
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The Influential Four

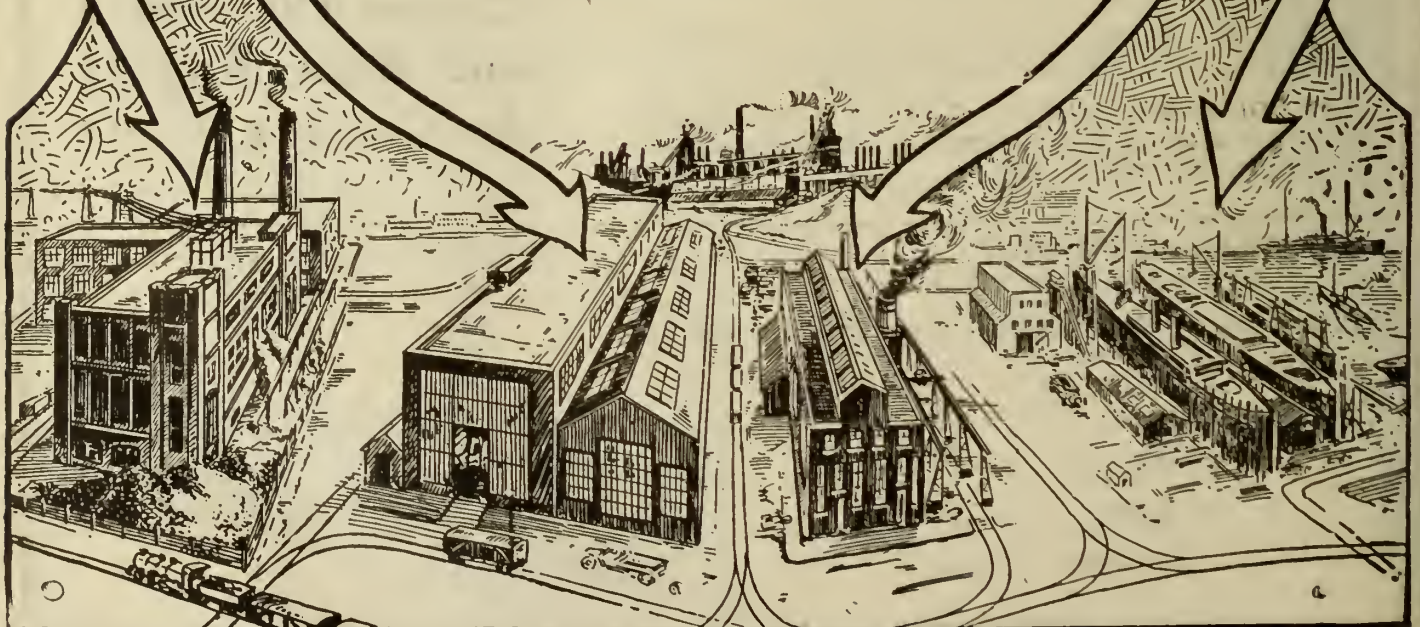
Interesting facts and figures about the MacLean publications which serve directly four of the most important industries in the Dominion of Canada—

POWER MACHINERY FOUNDRY and SHIPBUILDING

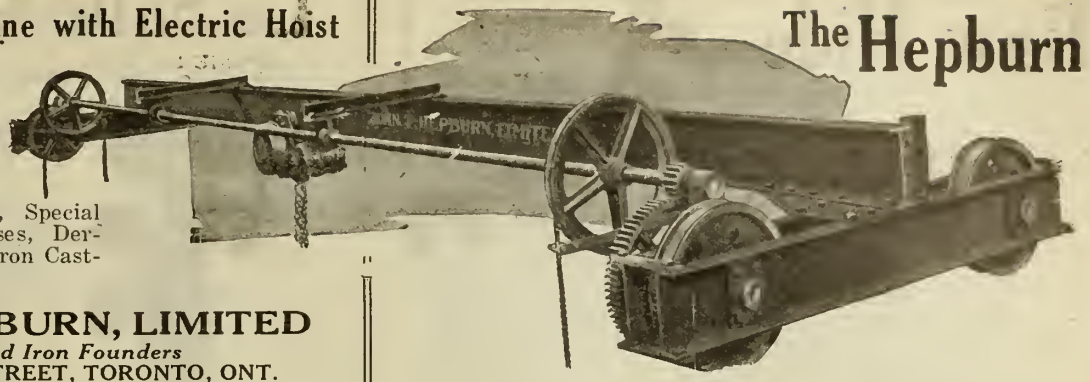
The MacLean Publishing Co., Limited

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Trade and Technical Newspaper and Magazine Publishers



Hand Overhead Crane with Electric Hoist



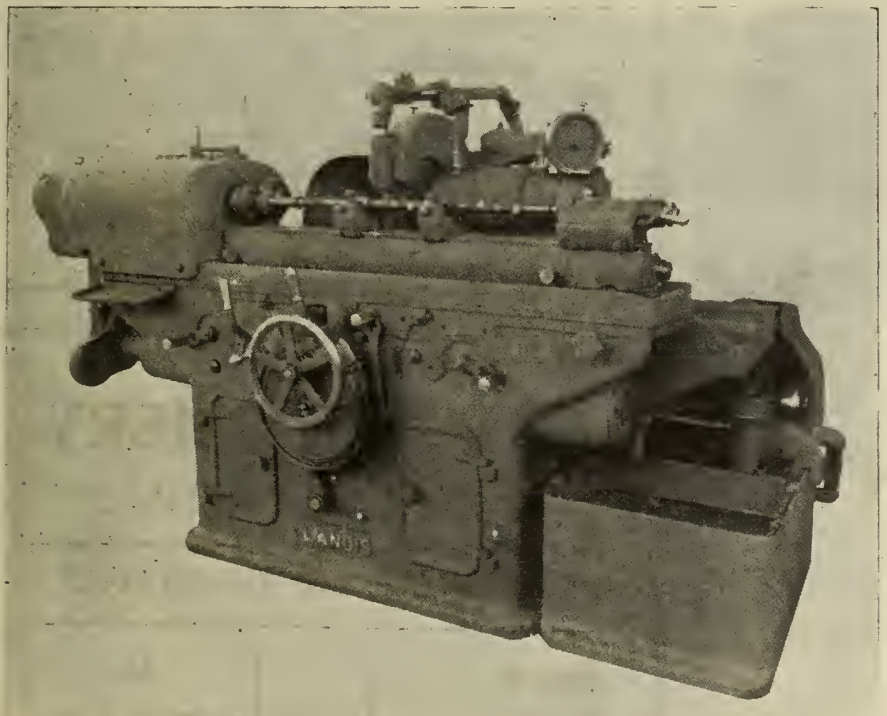
The Hepburn

These Cranes are easily manipulated and give no trouble. Hand chain hoists can be supplied if desired. Get quotations on our variety of Steam Pumps, Special Machinery, Planers, Presses, Derricks, Gear Cutting, Grey Iron Castings and Forgings.

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Engineers and Iron Founders
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LANDIS

New Cam Grinding Machine



Efficient— Productive— Accurate—

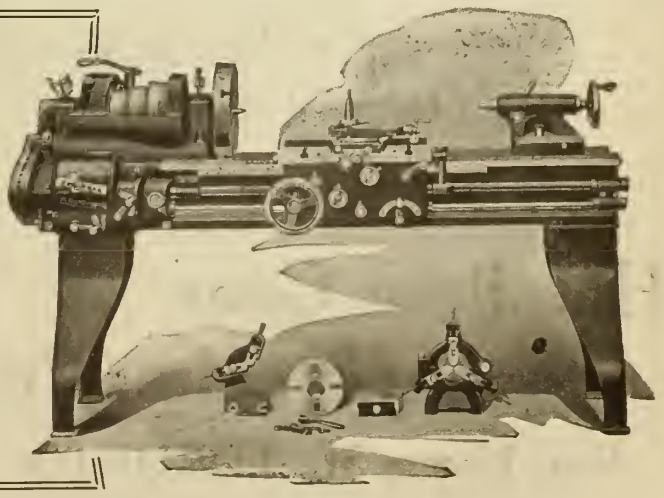
The New Landis Cam Grinding Machine embodies features of the latest design which assure the reproducing of perfect cam shapes, an important factor in automobile engine industry.

The attachment is constructed on the swinging underslung principle. The bracket being tubular in the cross-section and supported directly under the master cam and work centers, balances the swinging bracket, eliminating all strain. The work is carried directly over the fulcrum point, thus cutting down the difference in contour of cams caused by the changing diameter of the wheel. The master cam is mounted directly on the headstock. Together with many other important features, this attachment will meet the most exacting requirements.

If you are interested in accurate cam production, write for further information.

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WAYNESBORO, PA.
New York: 50 Church Street

High Powered and Extremely Accurate



For a small, heavy duty lathe of exceptional precision, the "Economy" Double Back Geared, Quick Change Engine Lathe has no equal. Though small in size it is of sufficient weight and power to handle the rapid production demanded in the modern manufacturing plant. Made in 14", 18" and 22" swing.

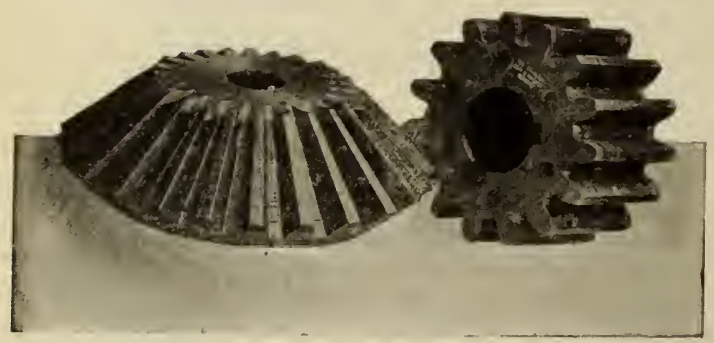
Have us send you full particulars of this machine without delay.

Rockford Lathe and Drill Co.
Rockford, Illinois

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Raw Hide Pinions for Silent Drives





Also silent pinions of

"CELERON"

A modern material which will withstand oil, water, steam or heat.

Write us for blue print of Design Standards.

Hamilton Gear & Machine Co.

Van Horne St., TORONTO

La Salle Grinders

TIME SAVING TOOLS FOR both PRECISION AND PRODUCTION



No. 1 Plain and Surface Grinder

(Micrometer Adjustment)

Grinding wheels .....8"x1"
Between wheels .....15"
Height to spindle center 40"
Table surface .....8"x14"

Has vertical travel of 12" on guides, ¾" by micrometer, and may be raised to within 2" of spindle center. Wheel grinds to center of a surface 9" wide.

Spindle speed....3,000 r.p.m.
Countershaft speed 1,000 r.p.m.
Floor space .....18"x24"
Net weight ..... 300 lbs.

This No. 1 Plain and Surface Grinder was designed for general use in both tool room and machine shop. It combines the cream of our experience with the most modern ideas in grinder construction.

The micrometer adjustment on the horizontal hand-wheel has graduations marked in 1000ths of an inch. These graduations are 5-32 of an inch apart, thus allowing a very fine adjustment of the table for depth of cut. The knee is brought to any required position by means of the vertical hand-wheel which turns a pinion in the rack, and is clamped solidly in place by the hand-nut at the left. The table is carried by a stiff post which moves vertically in the knee and is kept from turning horizontally by a feather.

Better have complete specifications of our Plain and Surface Grinders and Automatic Surface Grinders.

La Salle Tool Company

La Salle, Illinois, U.S.A.

GENUINE EMERY

Sizes 180, 160, 140, 120, 110, 100, 90, 80, 70, 60, 54, 46, 40, 36, 30, 24, 20, 18, 16, 14, 12, 10, 9, 8, hole.

EMERY FLOUR AND WASHED FLOUR

Emery Glass Flint Garnet Corundum Carborundum	Paper and Cloth	In Sheets, Rolls, Discs, Bands, Strips and Tapes, &c.

JOHN OAKEY & SONS

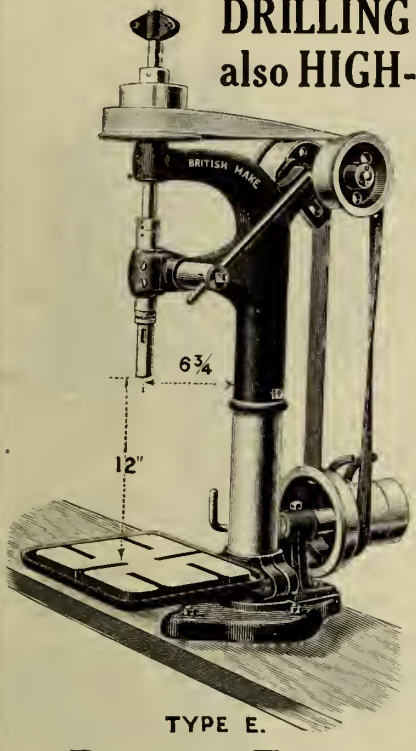
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SENSITIVE BENCH and PILLAR DRILLING MACHINES also HIGH-CLASS BALL BEARING DISC and TOOL GRINDERS



TYPE E.

TEN DIFFERENT TYPES, ALL FROM STOCK

Telegrams:—
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Beacon Engineering Co.
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Steel Fingers Slip into The Flutes



Grip the broken tap and back it out before you've had time to count three times sixty.

The Walton Tap Extractor

removes broken taps buried below the surface of the work without trouble or loss of time. It removes any broken tap without injuring the thread. It saves the casting or forging. Pays for itself over and over—often on the very first job.

How many do you want on trial?

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General Office and Works: Pittsburgh, Pa., U.S.A.

GAS AND STEAM ENGINES

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CASTINGS

Carbon Steel—Alloy Steel—Bronze
Air Furnace Iron Castings
Carbon and Alloy Steel Forging Ingots

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MESTA MACHINE CO.
Pittsburgh, Pa. U.S.A.

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Heat Under Accurate Control

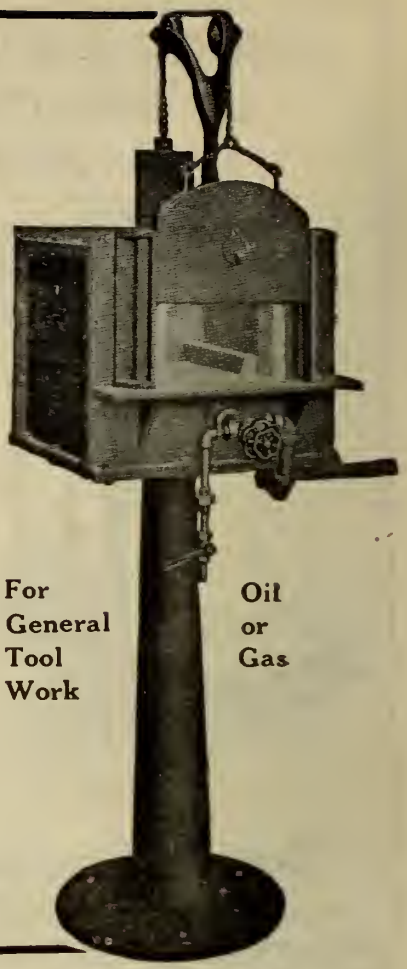
Here is an important factor in the heat treatment of metals. An intense heat, rapidly developed, and always under accurate control of the operator, are features that distinguish

BELLEVUE FURNACES

These tool forges are particularly adapted for the requirements of the small machine shop for annealing and tempering dies, cutters, reamers, etc.

Combustion is perfect and no flames come in contact with material. Built to stand the highest temperature. Doors are properly counterbalanced. In every way BELLEVUE FURNACES meet with the demand for durability, efficiency and convenience.

Let us advise you about your heat-treating problems



For General Tool Work

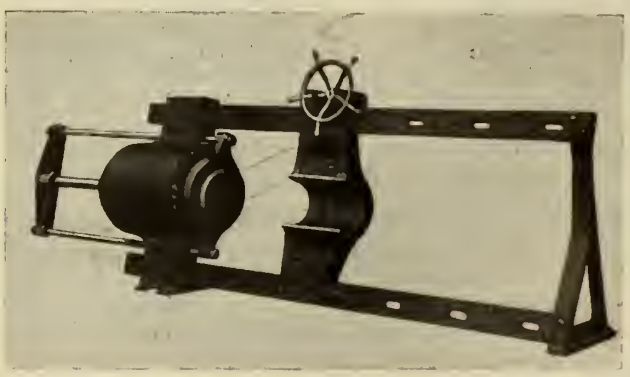
Oil or Gas

Bellevue Industrial Furnace Company

Julius C. Hinz, President

703 Bellevue Ave. - Detroit, Mich.

Representative in Canada: H. W. PETRIE, LIMITED, Toronto, Canada



PERRIN 400-Ton Hydraulic Wheel Press

This Made-in-Canada Press is built to operate direct from Accumulator at 1500 pounds per square inch pressure.

Perrin for Reliability

WILLIAM R. PERRIN, LIMITED

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for a large variety of grinding

if your variety of grinding is large invest in a Manhattan Universal Grinder. It is capable of handling cylindrical or internal grinding with the utmost in speed and accuracy.



Write for details.

Manhattan Machine & Tool Works

Grand Rapids, Mich., U.S.A.

Manhattan All-Around UNIVERSAL TOOL GRINDER

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2



Over 130,000 Square Feet of Floor Space Filled With Up-to-Date Machinery.

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WHEN ordering machinery or supplies there is something to consider besides quality—service is of equal importance.

The House of Petrie gives you both. You are assured of getting not only the highest grade machinery and supplies but getting them delivered when you want them, and at all times the price is right.

H. W. PETRIE LIMITED TORONTO

Canada's Dependable Machinery and Supply House

TO fill orders with the minimum of delay has always been our object. Our immense stock and excellent shipping facilities are a guarantee of prompt service.

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National Electro Products Limited announce to the Welding Trade of Canada that they are now handling a complete line of Welding and Cutting Apparatus which has proven highly successful, and is employed by many of the largest users.

This Line Includes:

Oxy-Hydrogen Cutting Torches
Oxy-Acetylene Welding and Cutting Torches
Regulators, Gauges, Hose, Goggles
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Electrolytic Oxygen and Hydrogen

are manufactured by the Company by an Electrolytic Process which assures gases of the highest purity. Factories are in operation in Toronto and Montreal, and others are under construction at different points.

These gases are backed by a SERVICE SYSTEM which assures prompt deliveries to all localities, in any desired quantities.

NATIONAL ELECTRO PRODUCTS LTD.

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For Welding Cutting and Lighting

HIGHEST GAS YIELD
IMPERIAL CARBIDE
MADE IN CANADA

It insures **effectiveness** and **economy** by **invariably** producing acetylene gas of **unusual purity.**

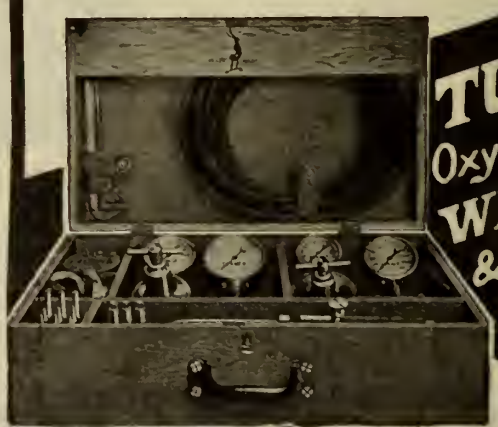
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Large Stocks maintained at convenient distributing centres throughout Canada

For Repairing Broken Machinery or Tools of Medium Size



TURNER
Oxy-Acetylene
WELDING
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Equipment

These outfits will soon pay their cost in machine parts or tools reclaimed. The sectional extensions of the torch enable the operator to adjust it to any desired length or angle. The location of valves is such that the flame is controlled by one hand, leaving the other hand free for the work at all times.

For full particulars write

The Turner Brass Works

SYCAMORE, ILLINOIS, U. S. A.

LINCOLN ARC WELDER

One good thing about Lincoln Welding is this:—

It does not matter what sized plant you have, or what you make in that plant, there are always occasions when you can use Lincoln Electric Welding.

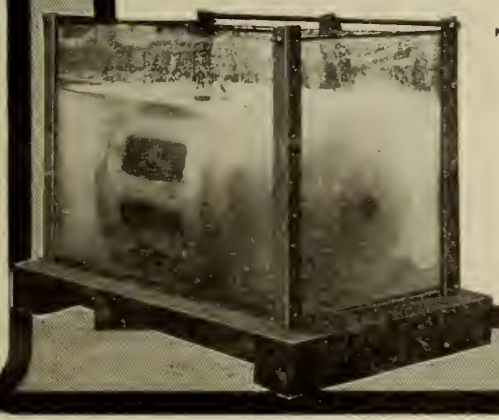
For this reason the utility of this process is great. However, whether it would pay you to install a welder of your own or not, is another matter. Perhaps it would be advisable to utilize the services of our welding department or to have one of our portable outfits come to your plant when breakages occur in your works.

This is a matter we can help you to decide.

But the point is that Lincoln Electric Welding is a piece of apparatus you will want to use at some time or other to save you time, money and machinery.

Therefore, to-day, call us up or write us, and we will have one of our engineers make an inspection of your plant. This will cost you nothing—it will not obligate you—it is a service we provide.

"Link up with Lincoln"



The Lincoln Electric Co. of Canada
LIMITED
Head Office and Works: 136 John St., Toronto
Phone Adelaide 7200
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The New Stirring and Stabilizing Process

Perfectype COMPLETE WELDING and CUTTING Equipment

Safe *Saves Money* *Makes Better Welds*

Regulators *Torches for Every Purpose* *Generators*

Canadian orders for Perfectype Special Type "A" Cutwelding Torches with 90 degree cutting head and 2 cutting tips, standard angle welding head and 5 welding tips of pure red copper will be delivered, duty and postage prepaid, from nearest jobber at the special price of $65.00.

Will consider inquiries from live dealers and jobbers who care to stock torches in lots of five or more. Territory granted. Inquiries confidential.

Address all orders and correspondence

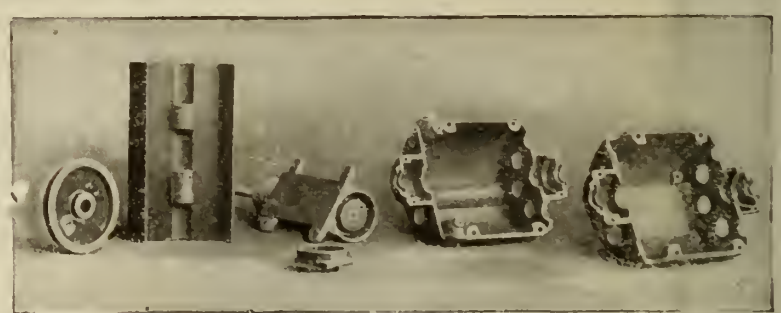
W. B. PERDUE, 1220 Post Street SAN FRANCISCO, Cal.

Die-Cast Parts Mean Speed!

WHY take two strokes where one is sufficient? Why have your small duplicate parts sand molded and machined when you can eliminate the machining by having them die-cast?

Die-Casting is the quickest, the cheapest, the most accurate method of making small duplicate parts. Die-Cast parts come to you clean and smooth —all ready to assemble.

Why not send us blue prints or samples for estimates to-day?



Die-Casting Chat No. 34

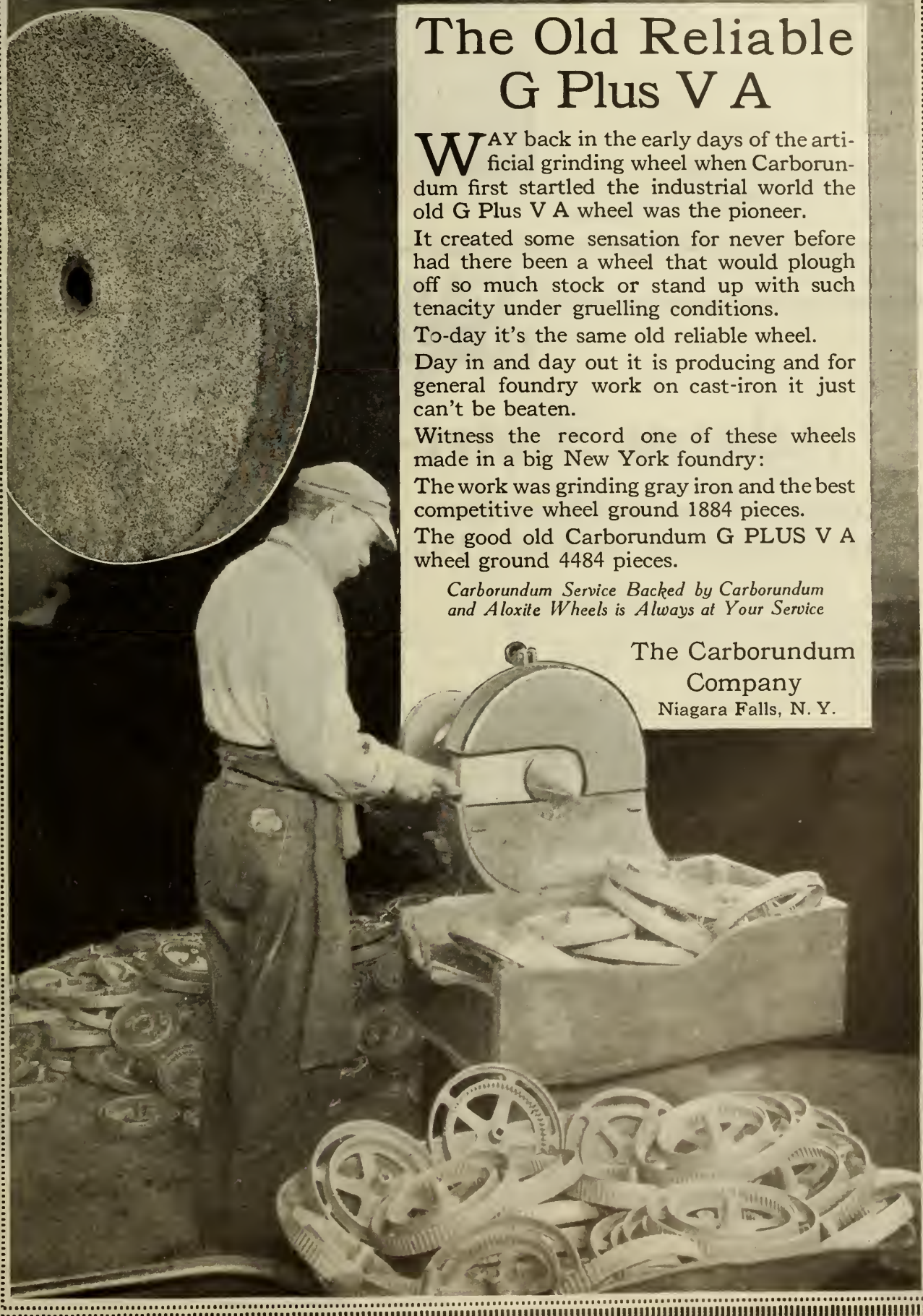
Would Die-Castings be an aid to you? Let us answer this question. We will tell you frankly just what Die-Castings will accomplish on your work. Remember, the Die-Casting Process is not an experiment. Manufacturers large and small are taking advantage of its time and labor saving. Let us tell you its value to you.

Largest Manufacturers of Die-Castings in Canada

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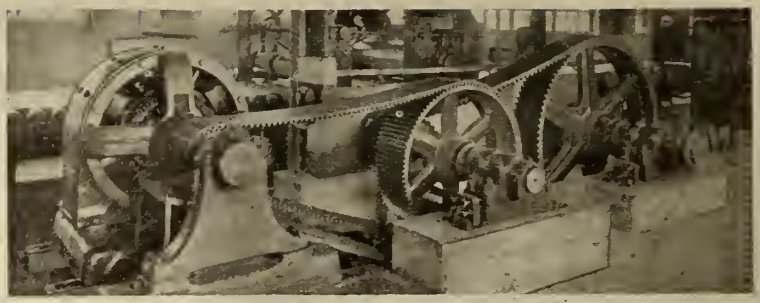
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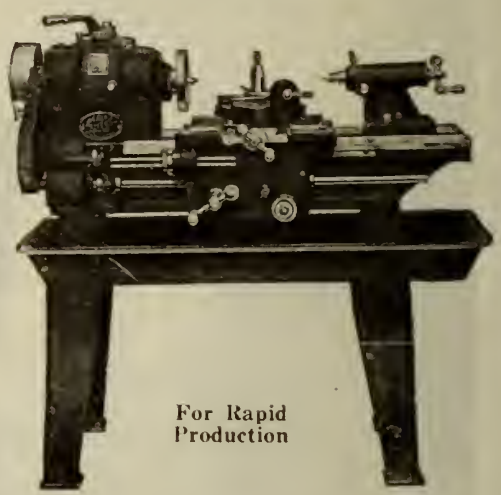
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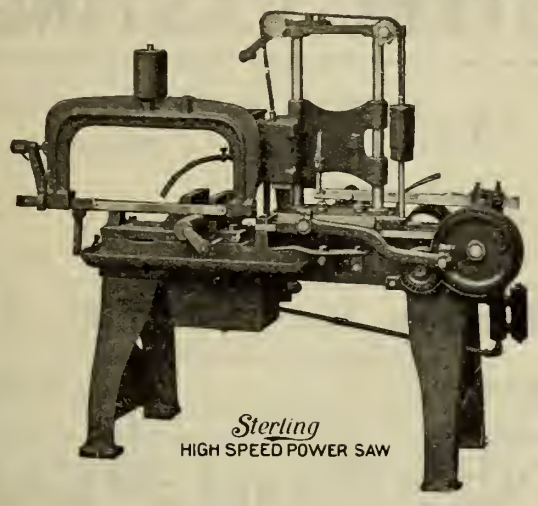
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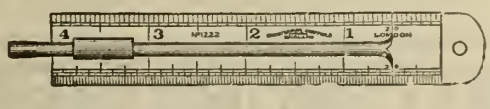
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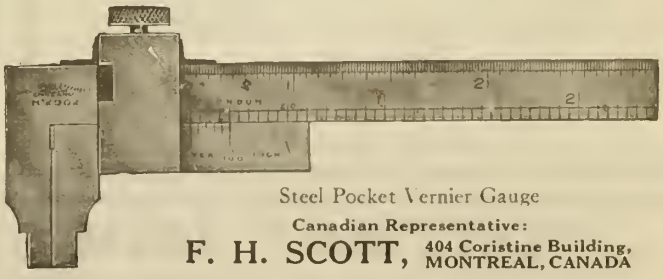


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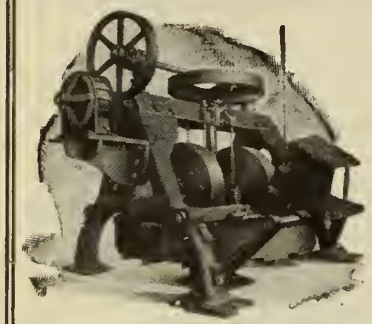
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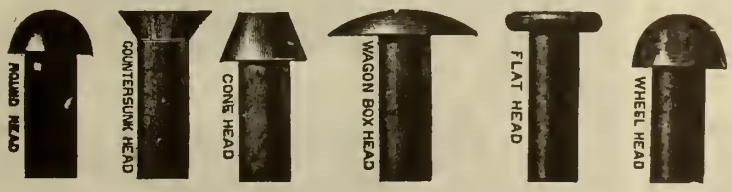
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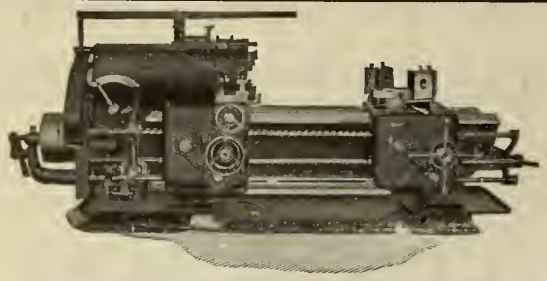
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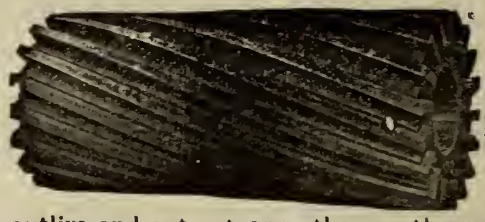
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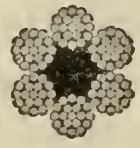
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Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., John, Ingersoll
Williams Mchy Co., A. R., Toronto, Ont.

BALLS, STEEL
Atkins & Co., Wm., Sheffield, Eng.
Chapman Double Ball Bearing Company, Toronto.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BAROMETERS
Taylor Instrument Co., Rochester, N.Y.

BARRELS, STEEL SHOP
Baird Machine Co., Bridgeport, Conn.
Cleveland Wire Spring Co., Cleveland.

BARRELS, TUMBLING
Baird Machine Co., Bridgeport, Conn.
Katie Foundry, Galt, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.

BARS, BORING
Gisholt Machine Co., Madison, Wis.
Madison Mfg. Co., Madison, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams & Co., J. H., Brooklyn, N.Y.

BARS, CONCRETE REINFORCING
Algoma Steel Corp., Sault Ste. Marie.

BARS, MERCHANT
Algoma Steel Corp., Sault Ste. Marie.
Peckovers, Ltd., Toronto, Ont.
United Alloys Steel Corporation, Canton, Ohio.

BASE FACING MACHINES
Victoria Foundry Co., Ottawa, Ont.

BATTERIES
Northern Electric Co., Ltd., Montreal, Que

BELT CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Summer & Co., New York, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

BEARINGS, GRAPHITE BRONZE
Lyman Tube & Supply Co., Montreal, Que.

BEARINGS, ROLLER
Lyman Tube & Supply Co., Montreal, Que.

BELT-LACING MACHINES, HOOKS AND PINS
Clipper Belt Lacer Co., Grand Rapids.

BELT LACING LEATHER
Aikenhead Hardware Co., Toronto, Ont.
G. F. Foss Mchy. & Sply. Co., Montreal.
Graton & Knight Mfg., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

BELTING, BALATA
Federal Engineering Co., Toronto, Ont.

BELT HOOKS, WIRE
Clipper Belt Lacer Co., Grand Rapids.

BELTING, RUBBER
Can. Consolidated Rubber Co., Montreal.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber Ltd., Toronto, Canada.

BELTING, CHAIN
Canadian Fairbanks-Morse Co., Montreal
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Renold of Canada, Ltd., Montreal.
Whitney Mfg. Co., Hartford, Conn.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, CONVEYOR
Can. Consolidated Rubber Co., Montreal.
Can. Link-Belt Co., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Federal Engineering Co., Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Graton & Knight Mfg., Worcesteh, Mass.
International Mchy. Spls., Ltd., Montreal
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McLaren Belting Co., J. C., Montreal.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co., Philadelphia, Pa.
Rice, Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal
Sumner & Co., New York, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, FRICTION AND SURFACE
Can. Con. Rubber Co., Ltd., Montreal.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, HAIR
Sumner & Co., New York, N.Y.

BELTING, LEATHER
Can. Graton & Knight Mfg. Co., Montreal
Gutta Percha & Rubber, Ltd., Toronto, Canada.

BELTING, RUBBER
International Mchy. Spls. Ltd., Montreal.
Quaker City Rubber Co., Philadelphia, Pa.

BELTING, STITCHED COTTON DUCK
Dominion Belting Co., Hamilton, Ont.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, WOVEN
Federal Engineering Co., Ltd., Toronto.
Sumner & Co., New York, N.Y.

BENDING MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.
Bertarm & Sons Co., John, Dundas.
Brown-Boggs Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Kitchener.
Dom. Steel Product Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BLAST GATES
W. S. Rockwell Co., New York, N.Y.

BLASTING MACHINES, SAND
Garlock-Walker Machinery Co., Toronto.
Jardine, A. B., & Co., Hespeler, Ont.
National Mach. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Strellnger, Chas. A. Co., Windsor, Ont.
Toledo Machine & Tool Co., Toledo.
Williams Mchy Co., A. R., Toronto, Ont.

BILLETS
Atkins & Co., Wm., Sheffield, Eng.
Swedish Steel & Importing Co., Ltd., Montreal.
Algoma Steel Corp., Sault Ste. Marie.
Marshall, Son & Bunney, Toronto.
United Alloy Steel Corp., Canton, Ohio.

BILLETS, FORGING
Dominion Foundries & Steel Ltd., Hamilton, Ont.

BINS, STEEL
Dennis Wire & Iron Works, London, Ont.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto, Ont
William Hamilton Co., Peterboro, Ont.

BLACKSMITH WORK
The Thos. Pink Co., Ltd., Pembroke.

BLOCKS, CHAIN
Oliver Engineering Co., Montreal.

BLOOMS AND SLABS
Algoma Steel Corp., Sault Ste. Marie.
United Alloy Steel Corp., Canton, Ohio.

BLOWERS
Can. Blower & Forge Co., Kitchener, Ont.
Garlock-Walker Machinery Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.

BLOWING ENGINES
General Combustion Co., Ltd., Montreal, Que.

BLOW PIPES AND REGULATORS
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.

BLUE PRINTING MACHINERY
Commercial Camera Co., Providence, R.I.

BLUE PRINT PAPER
Hughes, Owens Co., Ltd., Montreal, Que.

BOARTZ
Joyce, Koebel & Co., Inc., New York.

BOILER TUBES
Lyman Tube & Supply Co., Montreal, Que.

BOILER BREECHINGS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
William Hamilton Co., Peterboro, Ont.

BOLT CUTTERS
Fellows Gear Shaper Co., Springfield, Vt.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOILERS, RANGE
Can. John Wood Mfg. Co., Ltd., Toronto.

BOILERS
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.

BOILERMAKERS' TOOLS
Holden & Co., Ltd., Montreal, Que.

BOLT CUTTERS AND NUT TAPERS
Aikenhead Hardware Co., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Landis Machine Co., Waynesboro, Pa.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOLTS
Aikenhead Hardware Co., Toronto, Ont.
London Bolt & Hinge Wks., London, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Rice, Lewis & Son, Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton
Wilkinson & Kompass, Hamilton, Ont.
Williams & Co., J. H., Brooklyn, N.Y

BOLTS, COUPLING
Galt Machine Screw Co., Ltd., Galt, Ont.

BOLTS, STAY
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, SPRING SHAKLE
Can. Winkley Co., Ltd., Windsor, Ont.
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, PATCH
Morrow Screw & Nut Co., John, Ingersoll

BOLT AND NUT MACHINERY
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Mchy Co., A. R., Toronto, Ont.

BOLT THREADING MACHINERY
Jardine & Co., Ltd., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

BONDING MACHINES (Electric Railway)
The Lincoln Electric Co., Toronto, Ont.

BORING MACHINES, PNEUMATIC CYLINDER
Cleveland Pneumatic Tool Co., Toronto.
Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto.

BORING MACHINES, UPRIGHT AND HORIZONTAL
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Herbert, Ltd., Alfred, Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Hoefer Mfg. Co., Freesport, Ill.
Landis Tool Co., Waynesboro, Pa.
Oliver Machinery Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Rockford Drilling Mche. Co., Rockford, Ill.
Strelinger Chas. A. Co., Windsor, Ont.

BORING AND TURNING MILLS
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Foss Mch. & S'ply Co., Geo. F., Montreal
Herbert, Ltd., Alfred, Toronto, Ont.
Oliver Mach. Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.
Strelinger Chas. A. Co., Windsor, Ont.

BOXES, CAST IRON
Brown & Sharpe Mfg. Co., Providence, R.I.

BOXES, STEEL SHOP AND TOTE
Cleveland Wire Spring Co., Cleveland.

BARKES
Brown, Boggs & Co., Hamilton, Can.
Electric Steel & Metals, Ltd., Welland.

BRASS—SHEETS, ROLLS, PLATES, AND RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRASS ALLOYS
British Smelting & Refining Co., Ltd., Montreal, Que.

BRASS AND COPPER TUBING
Lyman Tube & Supply Co., Montreal, Que.

BRASS FOUNDERS
Canada Metal Co., Toronto.
Tallman Brass & Metal Co., Hamilton.

BRASS GOODS
Crane, Ltd., Montreal, Que.

BRASS PIPE AND TUBE
Crane, Ltd., Montreal, Que.

BRASS WORKING MACHINERY
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machinery Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Prest-O-Lite Co., Inc., Toronto, Ont.
Wood Turret Machine Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.
Brown's Copper and Brass Rolling Mills, New Toronto.

BRICKS, FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

BRIDGES, RLY. AND HIGHWAY
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

BROACHING MACHINES
Strelinger, Chas. A. Co., Windsor, Ont.

BRONZE—SHEETS, ROLLS, PLATES AND RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRONZE, NAVAL
Canada Metal Co., Toronto.

BRONZE COPPER
Tallman Brass and Metal Co., Hamilton.
Canada Metal Co., Toronto.

BRUSHES, CARBON
Lyman Tube & Supply Co., Montreal, Que.

BUFFING AND POLISHING MACHINERY
Ford-Smith Mach. Co., Hamilton.
Foss Mchy. & S'ply Co, Geo. F., Montreal
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BUCKETS, DUMP
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

BUCKETS, ELEVATOR
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

BUCKETS, CLAM SHELL, CRAB, DUMP
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd., Walkerville.

BULLDOZERS
Bertram & Sons Co., John, Dundas.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford
Garlock-Walker Machinery Co., Toronto.
Lourie Mfg. Co., Springfield, Ill.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

BURNERS, OIL AND NATURAL GAS
Northern Crane Works, Ltd., Walkerville.
W. S. Rockwell Co., New York, N.Y.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque.

BUSHING, BRONZE
Morrow Screw & Nut Co., John, Ingersoll

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CABLES, TRANSMISSION AND TELEPHONES
Northern Electric Co., Ltd., Montreal.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Carter Welding Co., Ltd., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Union Carbide Co., of Canada, Limited, Weland, Ont.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville.
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co., Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glasco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

CAR MOVERS
Holden Co., Ltd., Montreal, Que.

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Can. Metal Co., Toronto, Ont.

CASTINGS, DIE CAST
Can. Metal Co., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.
Fisher Motor Co., Ltd., Orilla, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

CASTINGS, STEEL—ALL KINDS
Canada Electric Castings, Ltd., Orilla, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co., Ltd., Orilla, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.

CARRIERS COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll.
Alexander Fleck Ltd., Ottawa.
Tallman Brass & Metal Co., Hamilton

CASTINGS, BENCH LEG
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt, Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown, Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co., Ltd., Orilla, Ont.
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
Interantional Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.
McFarlane Engineering Ltd., G. W., Paris, Ont.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd., Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Morrow Screw & Nut Co., J., Ingersoll.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machinery Co., Toronto.
Lyman Tube & Supply Co., Montreal, Q.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.
Renold of Canada, Ltd., Montreal.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Renold of Canada, Ltd., Montreal.
Williams Mchy. Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Can. Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N. Y.
Glasgow, N.S.
Renold of Canada, Ltd., Montreal.

CHAINS, SPROCKET WHEEL
Can. Link Belt Co., Ltd., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Ltd., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Labatory, Ltd., Toronto.

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, COLLET, AIR
Petrie, Ltd., H. W., Toronto.
Williams Mchy. Co., A. R., Toronto.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford
Foss Mchy. & Sply Co., Montreal.
Gardner, Robt. & Son, Montreal.
Garlock-Walker Machinery Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Herbert, Ltd., Alfred, Toronto, Ont.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Strelinger, Chas. A. Co., Windsor, Ont.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Warner & Swasey Co., Cleveland, O.
Williams Mchy. Co., A. R., Toronto, Ont.

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAY FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York, N.Y.

CLOCK SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.

CLOSETS
Crane, Ltd., Montreal, Que

CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

COAL CRUSHERS
Can. Link-Belt Co., Ltd., Toronto, Ont.

COAL HANDLING MACHINERY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Nova Scotia Steel & Coal Co., New

COLD ROLLED STRIP, ALL METAL COLLARS, SHAFTING
Can. Driver-Harris Co., Ltd., Walkerville.
Williams & Co., J. H., Brooklyn, N.Y.

COLLECTORS, PNEUMATIC
Can. Blower & Forge Co., Kitchener-Sturtevant Co., B. F., Galt, Ont.

COMPOSITION INGOT
Canada Metal Co., Toronto.

COMPOUNDS, CUTTING AND GRINDING, DRAWING STAMPING
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR
Atkins & Co., E. C., Hamilton, Ont.
Can. Ingersoll-Rand Co., Sherbrooke.
Cleveland Pneumatic Tool Co., Toronto.
Curtis Pneumatic Machy. Co., St. Louis.
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Superior Machinery Co., London, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CONDENSERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
MacGovern & Co., Montreal, Que.

CONDUITS
Northern Electric Co., Ltd., Montreal, Que.

CONNECTING RODS
Canada Found's & Forgings, Ltd., Welland, Ont.

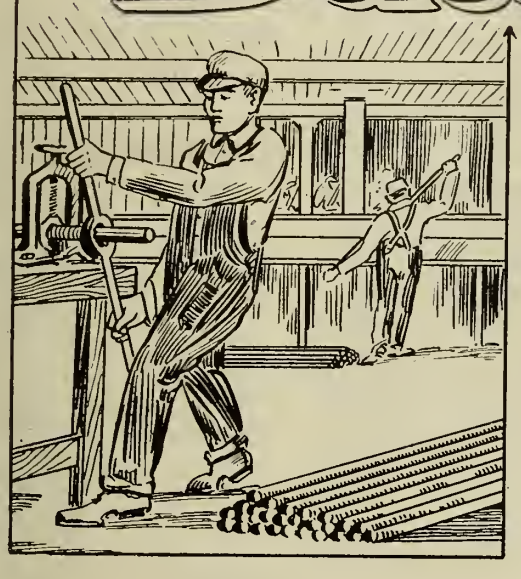
CONNECTING ROD CUTTERS INTERCHANGEABLE
Eclipse Counter bore Co., Ltd., Walkerville, Ont.

CONTRACT WORK
Brown Engineering Corp., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
Globe Engineering Co., Hamilton, Ont.
Katie Foundry, Ltd., Galt, Ont.
Victoria Foundry Co., Ottawa.

CONTROLLERS, MAGNETIC BRAKES, ELECTRIC WINCHES, MONO RAIL HOISTS
Volta Mfg. Co., Welland, Ont.

CONTROLLERS AND STARTERS
Williams Mach'y. Co., A. R., Toronto

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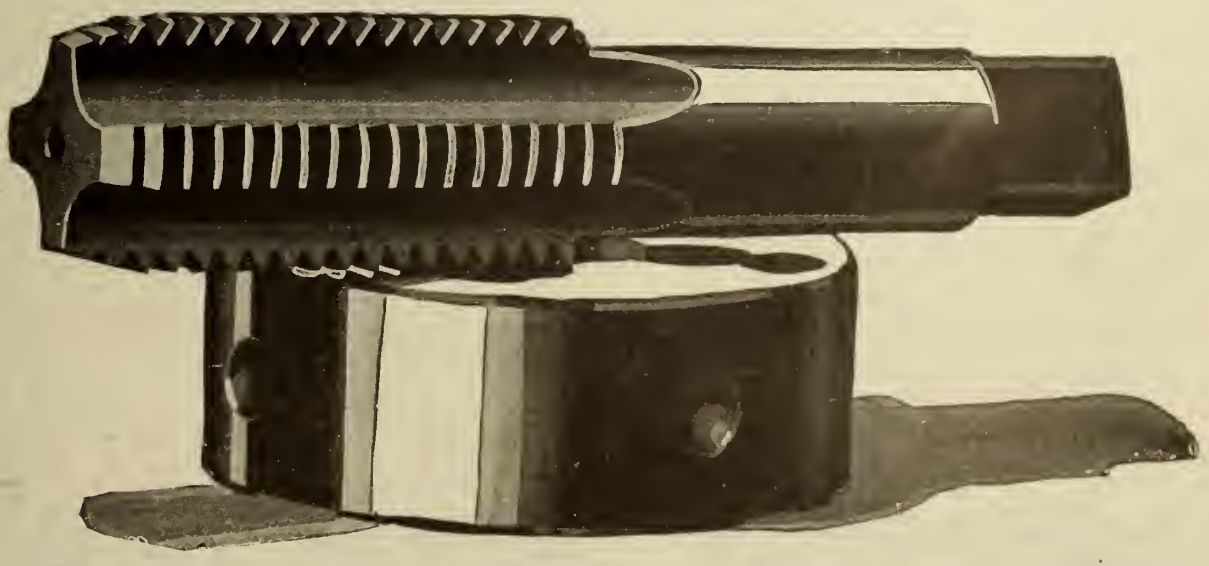
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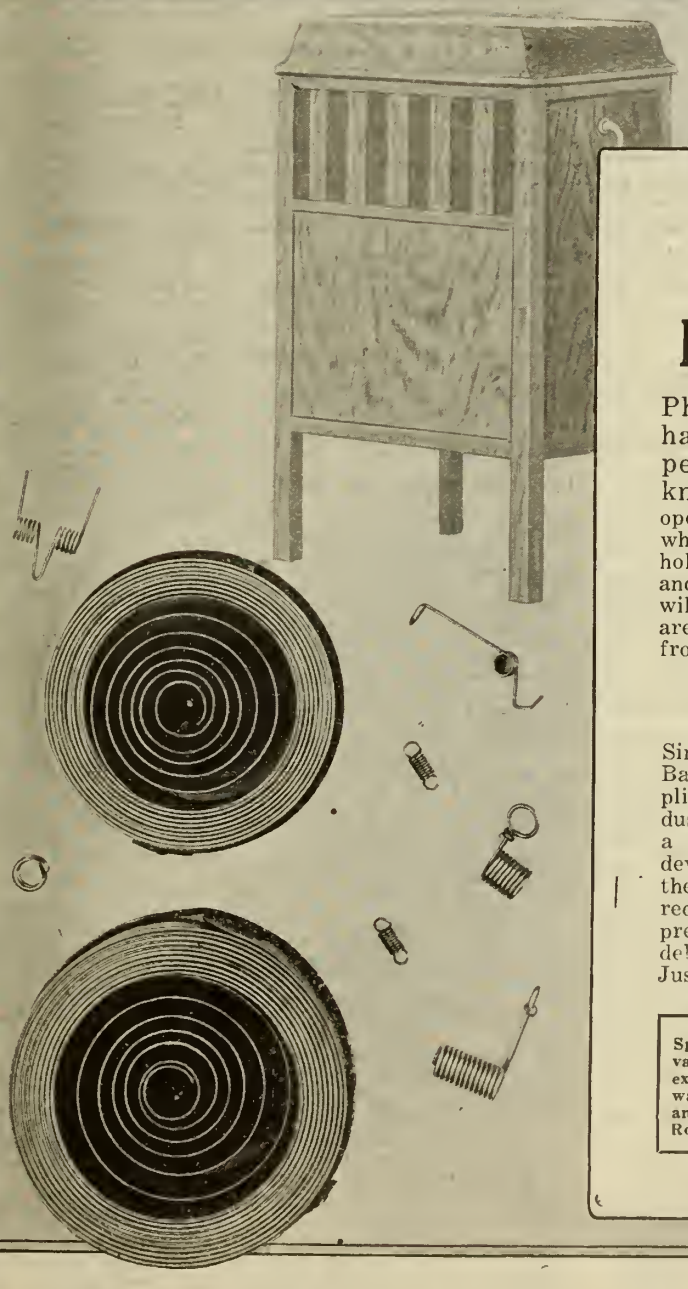
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Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

DRILLS, ROCK

Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
The Foss Mchy. & Supply Co., Montreal.
Holden Co., Ltd., Montreal, Que.
Samuel Osborne Ltd., Montreal, P.Q.
Strelinger, Chas. A. Co., Windsor, Ont.
A. R. Williams Machy. Co., Toronto.

DRILLS, SQUARE & HEXAGON

Globe Engineering Co.

DRILLS, TRACK

Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Holden Co., Ltd., Montreal, Que.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

DRINKING FOUNTAINS, SANITARY

Crane, Ltd., Montreal, Que.
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

DRIVES, CHAIN

See Belting, Chain.

DRIVING TOOLS

The Thos. Pink Co., Ltd., Pembroke, Ont.

DRY CLEANING SYSTEM

Bowser Co., Ltd., S. F., Toronto, Ont.

DRYERS, SAND

Lyman Tube & Supply Co., Montreal, Que.

DRYING APPLIANCES

Baird Machine Co., Bridgeport, Conn.
Sturtevant Co., B. F., Galt, Ont.
W. S. Rockwell Co., New York, N.Y.

DRUM CONTROLS

Volta Manufacturing Co., Welland, Ont.

DUMP CARS

Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.

DUST HANDLING EQUIPMENT

Sturtevant Co., B. F., Galt, Ont.

DUST SEPARATORS

Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

DYNAMOS AND ELECTRICAL SUPPLIES

Canadian Fairbanks-Morse Co., Montreal.
MacGovern & Co., Montreal, Que.
Strelinger Co., Chas. A., Windsor, Ont.
A. R. Williams Machy. Co., Toronto.

ELECTRICAL SUPPLIES

Lyman Tube & Supply Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal Que

ELECTRIC FURNACES

Electric Furnace Construction Co., Philadelpria, Pa.
Volta Manufacturing Co., Welland, Ont.

EECTRIC FURNACE REGULATORS, WINCHES, ROOF COOLERS AND ELECTRODE HOLDERS

Volta Manufacturing Co., Welland, Ont.

ELECTRIC HOISTS, STATIONARY AND MONO RAIL

Canadian Link-Belt Co., Ltd., Toronto,
Volta Manufacturing Co., Welland, Ont.

ELECTRIC MOTORS

Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
Volta Manufacturing Co., Welland, Ont.

ELECTRIC TRUCKS

Cowan Truck Co., Holyoke, Mass.

ELEVATOR, ENCLOSURES

Volta Mfg. Co., Welland, Ont.
Canada Wire & Iron Goods Co., Hamilton

ELEVATOR WEIGHTS

Katie Foundry, Galt, Ont.

ELEVATORS AND BUCKETS

Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis

ELEVATING AND CONVEYING MACHINERY

Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Petrie, Ltd., H. W., Toronto.

EMBOSSING PRESSES

Dom. Steel Products Co., Ltd., Brantford.
Oliver Machinery Co., Grand Rapids, Mich

EMERY GRINDERS (PNEUMATIC)

Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.

EMERY CLOTH

Atkins & Co., E. C., Hamilton, Ont.

EMERY PAPER

Atkins & Co., E. C., Hamilton, Ont.

EMERY AND EMERY WHEELS

Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford, Canada.
Tue Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.

EMERY WHEEL DRESSINGS

Dominion Abrasive Co., Ltd., Mimico, Ont.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor Ont.

ENAMELWARE

Crane, Ltd., Montreal, Que.

END MILLS

John Morrow Screw & Nut Co., Ingersoll

ENGINEERS—INDUSTRIAL CLEANING (Free Consultation)

Oakley Chemical Co., New York, N.Y.

ENGINEERS

Samuel Osborne (Canada) Ltd., Montreal.

ENGINES, STEAM, GAS, GASOLINE

Furniss, Clarke & Co., Montreal, Que.
Canadian Fairbanks-Morse Co., Montreal.
Holden Co., Ltd., Montreal, Que.
Johnson Mach. Co., Carlyle, Manchester, Conn.
MacGovern & Co., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

ENGINES, HORIZONTAL AND VERTICAL

Hamilton Co., Ltd., Wm., Peterborough, Ont.
Johnson Mach. Co., Carlyle, Manchester, Conn.
Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

ENGINES, OIL

Holden Co., Ltd., Montreal, Que.
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.

ENGINES, HEAVY OIL, DIESEL TYPE

Dom. Steel Products Co., Ltd., Brantford
Holden Co., Ltd., Montreal, Que.

ENGINES, MARINE

Can. Ingersoll-Rand Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

ENGINES, STATIONARY, FUEL, OIL, GAS OR GASOLINE

Holden Co., Ltd., Montreal, Que.

ESCUTCHEON PINS

Parmenter & Rulloch, Gananoque, Ont.

EXHAUST HEADS AND HOODS

Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Sturtevant Co., B. F., Galt, Ont.

EXHAUSTERS

Can. Blower & Forge Co., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
Can. Driver-Harris Co., Walkerville, Ont.

EXTRACTORS, TAP

Walton Co., The, Hartford, Conn.

EYE BOLTS AND NUTS

Can. Foundries & Forgings, Ltd., Welland, Ont.

EYE PROTECTORS

Standard Optical Co., Geneva, N.Y.

FACTORY LOCATIONS

City of St. Johns, Quebec.

FACTORY SITES

City of St. Johns, Quebec.

FANS

Baird Machine Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

FENCE, IRON AND FACTORY

Can. Wire & Iron Goods, Hamilton, Ont.

FERRO-TUNGSTEN

Vanadium-Alloys Steel Co., Pittsburgh, Pa

FIBRE, RODS AND SHEETS

Diamond State Fibre Co., Bridgeport, Pa.

FILES

Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Wm., Sheffield, Eng.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Marshall, Son & Bunney, Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.

FILES, COMMUTATOR SLOTTING

Lyman Tube & Supply Co., Montreal, Que.

FILING MACHINES, BENCH AND MOTOR DRIVEN

Cochrane-Bly Co., Rochester, N.Y., U.S.A

FILTERING AND CIRCULATING SYSTEMS FOR LUBRICATING OIL

Bowser Co., Ltd., S. F., Toronto, Ont.
Can. Wire & Iron Goods, Hamilton, Ont.

FIRE BRICK

Elk Fire Brick Co., Hamilton, Ont.
General Combustion Co., Ltd., Montreal, Que.

FIRE CLAY

Elk Fire Brick Co., Can., Ltd., Hamil
General Combustion Co., Ltd., Montreal, Que.

FINISHING MACHINES

Brown & Sharpe Mfg. Co., Providence, R.I.

FITTINGS, CAST IRON, SCREWED, FLANGED

Crane, Ltd., Montreal, Que.

FIXTURES

Brown Engineering Corp., Toronto, Ont.
Crescent Mchc. Co., Ltd., Montreal, Que.

FLAT SPRINGS

The Dunbar Brothers Co., Bristol, Conn

FLEXIBLE SHAFT EQUIPMENT

R. C. Haskins Co., Chicago, Ill.

FLOODLIGHTS, ELECTRIC

Holden Co., Ltd., Montreal, Que.
Northern Electric Co., Ltd., Montreal, Que

FLOTATION MACHINERY

Elec. Steel & Metals, Welland, Ont.

FLUMES

Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
William Hamilton Co., Peterboro, Ont.

FORGES, HAND PORTABLE

Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.

FORGE TOOLS

Kinaber & Hillier Mfg., Co., St. Catharines, Ont.

FORGES, OIL

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

FORGINGS

Mesta Machine Co., Pittsburgh, Pa.
Can. Found. & Forgings, Ltd., Welland.
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

FORGINGS, DROP, AUTOMOBILE AND LOCOMOTIVE FORGING AND WELDING

Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamp'g Co., Walkerville
Steel Co. of Canada, Ltd., St. Catharines
Victoria Foundry Co., Ottawa.
Williams & Co., J. H., Brooklyn, N.Y.

FORGING MACHINERY

John Bertram & Sons Co., Dundas, Ont.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont
National Machy. Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.

FORGINGS, SPECIAL

Armstrong-Whitworth of Can., Montreal.
Can. Found. & Forgings, Ltd., Welland.
Williams & Co., J. H., Brooklyn, N.Y.

FORMING

Brown & Sharpe Mfg. Co., Providence, R.I.

FOUNDRY EQUIPMENT

Herbert Ltd., Alfred, Toronto, Ont.

FRICTION LEATHERS

Graton & Knight Mfg. Co., Montreal

FRICTION SURFACE BELTING

Can. Consolidated Rubber Co., Montreal.

FUEL OIL SYSTEMS

Bowser Co., Ltd., S. F., Toronto, Ont.

FURNACES, ANNEALING, CASE HARDENING AND TEMPERING

Bellevue Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Gen. Combustion Co, Can., Ltd, Montreal
Mechanical Eng'r'g Co., Three Rivers, Q
W. S. Rockwell Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.

FURNACES, BLAST

Bellevue Industrial Furnace Co., Detroit
W. S. Rockwell Co., New York, N.Y.
Toronto Iron Works, Ltd., Toronto.

FURNACES — BRASS MELTING

General Combustion Co., Ltd., Montreal

FURNACES, ELECTRIC

Electric Furnace Construction Co., Philadelpria, Pa.

FURNACES, FORGING

Gen. Combustion Co. of Can., Ltd., Montreal.
W. S. Rockwell Co., New York, N.Y.

FUSE BOXES, STEEL

Dom. Forge & Stamp. Co., Walkerville

FUSE PLUGS AND FUSES

Northern Electric Co., Ltd., Montreal Que.

GALVANIZING FLUX

British Smelting & Refining Co., Ltd. Montreal, Que.

GANG PLANER TOOLS

Armstrong Bros. Tool Co., Chicago.

GAS AND STEAM ENGINES

Mesta Machine Co., Pittsburgh, Pa.

GASKETS, LEATHER, ETC.

Graton & Knight Mfg. Co., Montreal.
Holden Co., Ltd., Montreal, Que.

GASOLINE METERS

Bowser Co., Ltd., S. F., Toronto, Ont.

GASOLINE TANKS

Bowser Co., Ltd., S. F., Toronto, Ont.

TWO GREAT GUILDS

ONE hundred years before Columbus landed in America, there was established in England a guild of gold and silver smiths who, through pride of craft, established a mark whereby when a housewife bought silverware and saw on it the word "Sterling" she made her purchase with absolute assurance of value received.

Five centuries have passed since that mark was established. To-day it still remains an unerring guide throughout the English-speaking world, and woe betide the man or firm who misuses this mark "Sterling." The police of the world stand back of it.

Only six short years ago there was established on the North American Continent another guild of craftsmen — another body of men with pride of achievement—the guild of Advertisers, Advertising Agents and Publishers.

They, too, adopted a hall mark to designate an honest product in the business in which they were engaged.

Sentiment, genius or instinct guided the adoption of the three great foundational letters A.B.C. as their insignia. In one respect alone did these two great guilds, of craftsmen—separated in birth by over five centuries—differ. One determined the fineness alone, and left the purchaser to measure the weight. The other determined the weight but gave such specific information as would enable the buyer to determine for himself the degree to which that fineness applied to his own particular business.

A.B.C. stands for Audit Bureau of Circulations, and Audit Bureau of Circulations stands for absolute honesty in the preparation and presentation of circulation statements. The advertiser who buys space in a publication whose circulation is audited by the A.B.C. knows exactly what he is getting.

Canadian Machinery and all MacLean Publishing Company papers are members of the A.B.C.

CANADIAN MACHINERY

BUYERS' DIRECTORY

Volume XXIV.

GASOLINE PUMPS, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

GAUGES
Crescent Mach. Co., Ltd., Montreal, P.Q

GAUGERS, CALIPERS
Williams & Co., J. H., Brooklyn, N.Y

GAUGES, DIAL
Herbert, Ltd., Alfred, Toronto, Ont.

GAUGES, MERCURY COLUMN, DRAFT
Taylor Instrument Co., Rochester, N.Y.

GAUGES, HYDRAULIC
Taylor Instrument Co., Rochester, N.Y.

GAUGES, MANUFACTURERS, LIMIT, THREAD
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Can., Galt, Ont

GAUGES, SNAP, THREAD AND CYLINDRICAL
C. E. Johanson, Inc., Toronto, Ont.

GAUGES, VACUUM AND PRESSURE
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Rochester, N.Y

GAUGES, STANDARD
Brown Engineering Corp., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Crescent Mche. Co., Ltd., Montreal, Que.
Garvin Machine Co., New York.
C. E. Johanson, Inc., Toronto, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Hartford, Conn
Strelinger, Chas. A. Co., Windsor, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Wells Brothers Co. of Canada, Galt, Ont.

GEAR BLANKS
an. Steel Foundries, Ltd., Montreal,
om. Found. & Steel, Hamilton, Ont.
Williams & Co., J. H., Brooklyn, N.Y

GEAR BLANKS, CAST
Katie Foundry, Galt, Ont.

GEAR BLANKS, RAWHIDE
Lyman Tube & Supply Co., Montreal, Que.

GEAR BOXES, REDUCTION
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEAR SHAPERS AND CUTTERS
Fellows Gear & Shaper Co., Springfield, V.

GEAR-CUTTING MACHINERY
Bilton Mach. Tool Co., Bridgeport, Conn.
Fellows Gear & Shaper Co., Springfield, V.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

GEAR-TESTING MACHINE
Gisholt Machine Co., Madison, Wis.

GEARS, CHAIN
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.
Renold of Canada Ltd., Montreal.

GEARS, COMPENSATING
Morse Chain Co., Ithaca, New York.
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, CUT, MORTISE, ANGLE, WORM
Can. Link-Belt Co., Toronto, Ont.
Diamond State Fibre Co., Bridgeport, Pa.
Dom. Steel Products Co., Ltd., Brantford.
Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Found., Ltd., Hull, Q
Jones & Glassco, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia
Victoria Foundry Co., Ottawa.

GEARS, RAWHIDE
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough,
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
A. R. Williams Machy. Co., Toronto.

GENERATORS, GEAR
Fellows Gear & Shaper Co., Springfield, V

GEARS, SILENT CHAIN
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, SPRING
Morse Chain Co., Ithaca, New York.

GEARS, SPUN, BENCH, SPIRAL
Brown & Sharpe Mfg. Co., Providence, R.I.

GENERATORS AND CONVERTORS
Northern Elec. Co., Ltd., Montreal, P.Q.

GENERATORS, MOTOR
MacGovern & Co., Montreal.
Northern Elec. Co., Ltd., Montreal, P.Q.
Sturtevant Co., B. F., Galt, Ont.

GENERATORS, STEAM TURBO
an Link-Belt Co., Ltd., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.

GILDING
Brown's Copper and Brass Rolling Mills New Toronto.

GLUE HEATERS
Oliver Machinery Co., Grand Rapids, Mich

GLASSES, SAFETY
Willson Goggles, Inc., Reading, Pa.

GRAPHITE
Aikenhead Hardware, Ltd., Toronto.
Rice Lewis & Son, Toronto.

GOGGLES
Standard Optical Co., Geneva, N.Y.

GRAB BUCKETS—CLAMSHELL and ORANGE PEEL
Canadian Link-Belt Co., Ltd., Toronto, Ont.

GRAVITY CARRIERS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
Morris Crane & Hoist Co., Ltd., Herbert Niagara Falls, Ont.

GREASE CUPS, PRESSED STEEL, BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES (See Lubricants)

GRINDERS, AUTOMATIC KNIFE
Canada Machinery Corp., Galt, Ont.
Foss Mchry. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto.

GRINDERS, AUTOMATIC SURFACE
La Salle Tool Co., La Salle, Ill.

GRINDERS, BENCH
Superior Machinery Co., London, Ont.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Can. Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Haskins & Co., R. C., Chicago, Ill.
Wisconsin Electric Co., Inc., Racine, Wis
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Katie Foundry, Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec. Tool Co., Cincinnati.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CUTTER
Brown & Sharpe Mfg. Co., Providence, R.I
Cincinnati Milling Mach. Co., Cincinnati.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Globe Engineering Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, DIE AND CHASER
Haskins & Co., R. C., Chicago, Ill.
Landis Machine Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., E. C., Hamilton, Ont.
Ford-Smith Mach. Co., Hamilton.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., Worcester, Mass.

GRINDERS, FLEXIBLE CASTING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, DRILL
Aikenhead Hardware Co., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
La Salle Tool Co., La Salle, Ill.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CYLINDER, INTERNAL
Brown & Sharpe Mfg. Co., Providence, R.I
Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, PORTABLE, ELECTRIC HAND, TOOL POST, FLOOR AND BENCH
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Mach. Co., Hamilton, Ont.
Haskins & Co., R. C., Chicago, Ill.
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
United States Elec. Tool Co., Cincinnati
Wisconsin Electric Co., Inc., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

GRINDERS, HOLE, HOLE AND AND DEEP HOLE
Barber Mchy. Co., Ltd., Toronto, Ont.
Bryant Chucking Grinder Co., Springfield, Vermont.
Heald Machine Co., Worcester, Mass.

GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co., Toronto.
Garlock-Walker Machinery Co., Toronto.
Heald Machine Co., Worcester, Mass.
Independent Pneumatic Tool Co., Chicago
MacGovern & Co., Montreal, Que.

GRINDERS, PROFILE
Cleveland Milling Machine Co., Cleveland.

GRINDERS, ROTARY SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Bristol Machine Tool Co., Bristol, Conn.
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, TOOL AND HOLDER
Armstrong Bros. Tool Co., Chicago.
Blount & Co., J. G., Everet, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

GRINDERS, UNIVERSAL, PLAIN
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

GRINDERS, VERTICAL SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Montreal.
Heald Machine Co., Worcester, Mass.
Herbert, Ltd., Alfred, Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Norton Co. of Canada, Ltd., Hamilton, Ont
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont

GRINDING AND POLISHING MACHINES, PORTABLE, PNEUMATIC AND SPRING FRAME
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Elec. Tool Co., Cincinnati, O
Ford-Smith Mach. Co., Hamilton, Ont
Gardner & Son, Robt., Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass
Haskins & Co., R. C., Chicago, Ill.
Hall & Sons, John H., Brantford, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Niles-Bement-Pond Co., New York, N.Y
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto
Strelinger Co., C. A., Windsor, Ont.
Wisconsin Electric Co., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.
Williams Tool Corp. of Can. Ltd., Brantford, Ont

GRINDING MACHINES, CAR WHEEL, CUTTER, CYLINDRICAL, CRANKSHAFT
Brown & Sharpe Mfg. Co., Providence, R.I
Norton Co. of Canada, Ltd., Hamilton, Ont.

GRINDING WHEELS
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford
Can. Fairbanks-Morse Co., Montreal.
Carborundum Co., Niagara Falls, N.Y.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Mchy. & S'ply Co. G. F., Montreal
Norton Co. of Canada, Ltd., Hamilton, Ont.

GRINDING WHEEL DRESSER
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Norton Co. of Canada, Ltd., Hamilton, Ont.

GUARDS, WINDOW AND MACHINE
Canada Machinery Corp., Galt, Ont.
Canada Wire & Iron Goods Co., Hamilton
Dennis Wire & Iron Works, London, Ont
B. Greening Wire Co., Hamilton, Ont.

GUTTERS AND SKYLIGHTS
H. H. Robertson, Ltd., Sarnia, Ont.

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Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.

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Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Foss Mchy. & S'ply Co., G. F., Montreal
Ford-Smith Machine Co., Hamilton.
Perfect Machine Co., Galt, Ont.
Starrett Co., L. S., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy, Co., A. R., Toronto.
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Bliss Co., E. W., Brooklyn, N.Y.
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United Hammer Co., Boston, Mass.
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HAMMERS, POWER
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Oliver Engineering Co., Montreal, P.Q

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Graton & Knight Mfg. Co., Montreal

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Chapman Double Ball Bearing Co., Toronto.
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Baird Machine Co., Bridgeport, Conn.

HINGES
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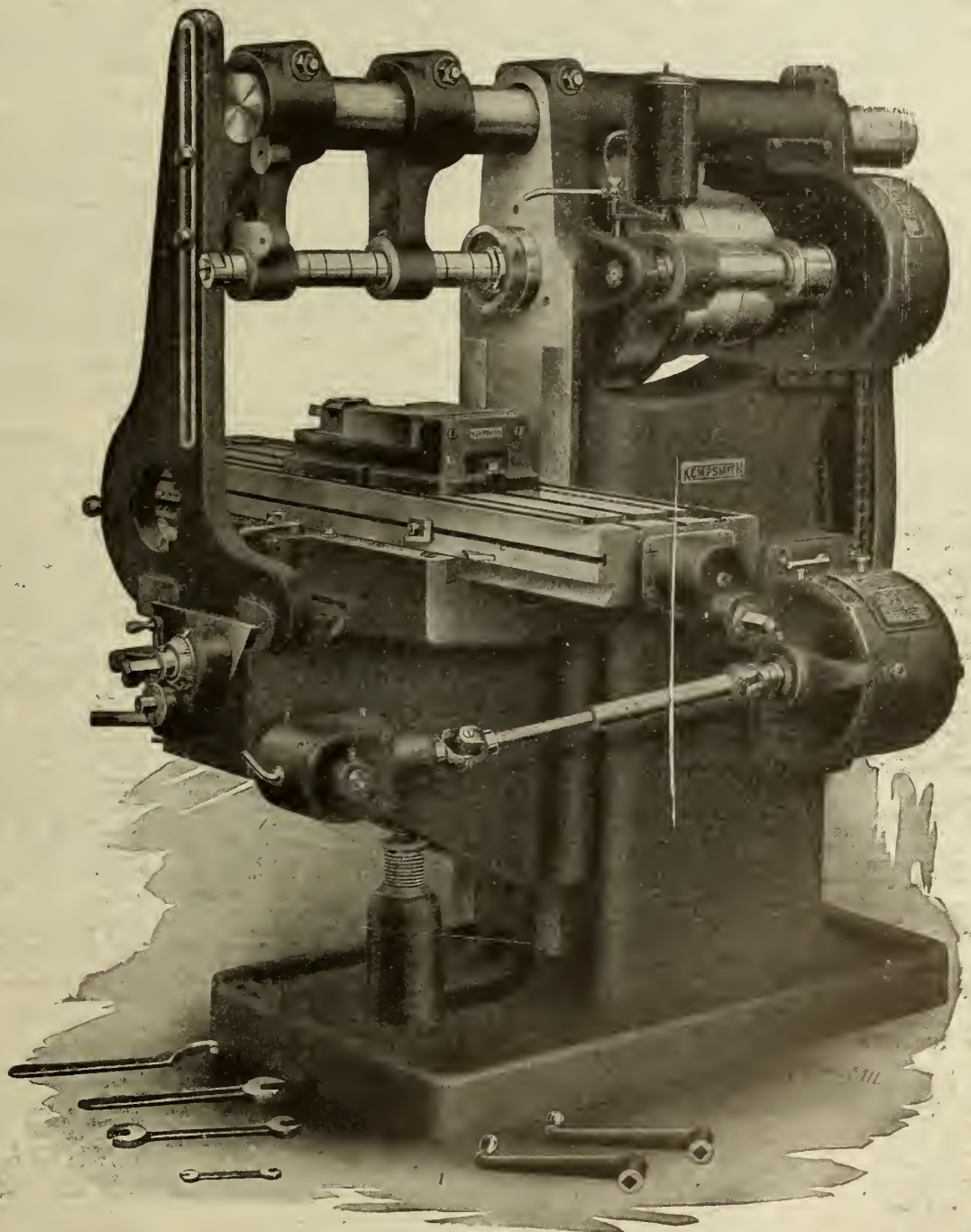
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Pratt & Whitney Co., Dundas, Ont.
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Strelinger, Chas. A. Co., Windsor, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

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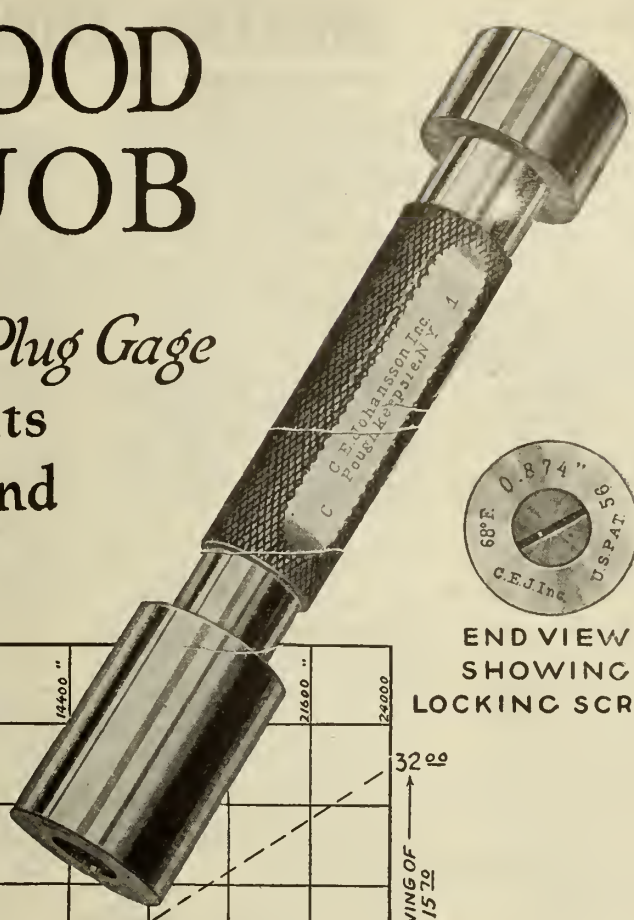
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Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co. Toronto, Ont.
Herbert, Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Niles-Bement-Pond Co., New York.
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Strelinger, Chas. A. Co., Windsor, Ont.
United States Mach. Tool Co., Cincinnati.
Williams Machy. Co., A. R., Toronto

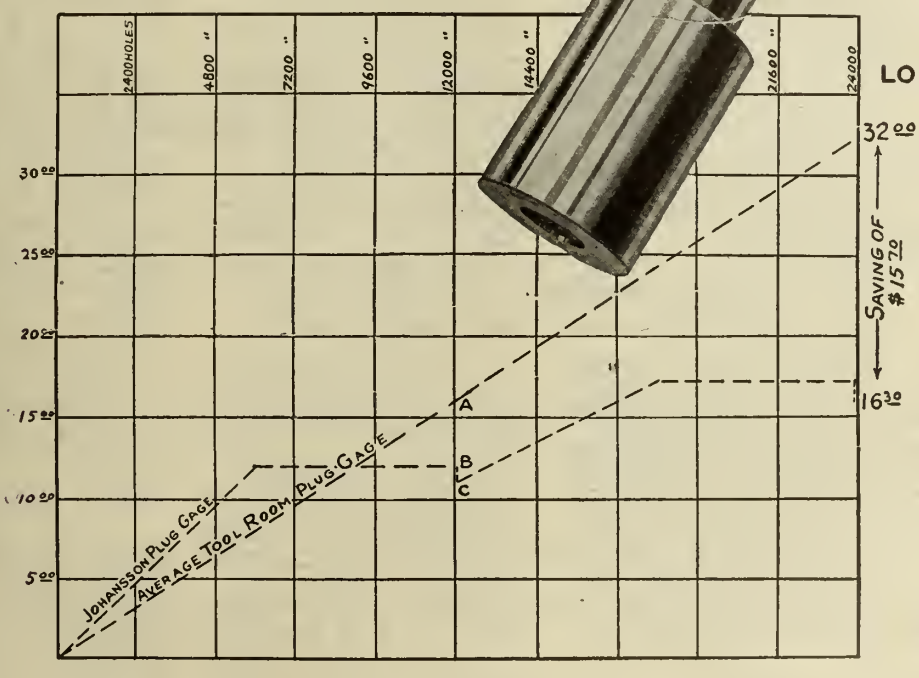
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Cleveland Milling Machine Co., Cleveland.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.

MAKING GOOD ON ITS JOB

A *Johansson Tolerance Plug Gage* makes good through its dependable *accuracy* and *saving* in *cost*



END VIEW SHOWING LOCKING SCREW





THE seasoning, heat treating and exclusive Johansson finishing processes, the same as used on Johansson Blocks, insure a progressive accuracy of .00004" on each plug gage. The reversible gaging ends and the improved locking screw give the gage its long life.

"MAKING GOOD" these days also means "saving." The above comparative test proves Johansson Plug Gages the more economical. The first cost of the Johansson Gage is $12 compared with $4 for the manufacturer's average own make gage. The Johansson Gage will inspect 6,000 holes before losing its accuracy, as against 3,000 for the average gage. By reversing the end of the Johansson Gage (represented by the horizontal line ending at B) another 6,000 holes are gaged with no increased cost. The drop BC shows the salvage, $1, refunded on the old end when returned.

AT the line ABC (12,000 holes) four average "own make" gages have cost $16 as against $11 for the Johansson Gage. If a new gaging end is then bought for $6.30, at 24,000 holes, the final standing, after the second salvage, is $32 as against $16.30, or a saving of $15.70, by using the Johansson Gage.

LET us show you how Johansson Tolerance Plug Gages can also make good in your plant.

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Toronto, Ont.

Williams & Wilson, Ltd.
Montreal, Que.

Chas. A. Strelinger of Canada, Ltd.
Windsor, Ontario

C. E. Johansson, Inc.
Poughkeepsie, N.Y.

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Foss Mchy. & S'ply Co., G. F., Montreal.
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Garvin Machine Co., New York.
Herbert, Ltd., Alfred, Toronto, Ont.
National Machy. Co., Tiffin, Ohio.
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Hendey Machine Co., Torrington, Conn.
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Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
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Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Brown & Sharpe Mfg. Co., Providence.
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Kempsmith Mfg. Co., Milwaukee, Wis.
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Williams Mchy Co., A. R., Toronto, Ont.

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dominion Bridge Co., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Pratt & Whitney Co., Dundas, Ont.

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Elec. Steel & Metals, Welland, Ont.
Holden Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Frost Mfg. Co., Chicago, Ill.

MORTISING CHAINS

Renold of Canada Ltd., Montreal.

MORTISING MACHINES

Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.

MOTORS, ELECTRIC

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Garlock-Walker Machy. Co., Toronto, Ont.
Toronto.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Sturtevant Co., B. F., Galt, Ont.
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Graton & Knight Mfg. Co., Worcester, M.

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Turner Brass Works, Sycamore, Ill.

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Pilot Steel & Tool Co., Montreal, Que.

NICKEL STEEL

See Steel.

NICKEL SILVER—SHEETS, ROLLS, PLATES and RODS

Brown's Copper and Brass Rolling Mills, New Toronto.

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Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
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Williams Tool Corp. of Can. Ltd., Brantford, Ont.

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OIL SEPARATORS

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OIL STONES

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Norton Co. of Canada, Ltd., Hamilton, Ont.
Norton Co., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

OIL STONE GRINDERS

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OIL STORAGE SYSTEMS

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Wells Bros. of Canada, Galt, Ont.

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Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co., Philadelphia, Pa

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Frost Mfg. Co., Chicago, Ill.

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Can. Link-Belt Co., Toronto, Ont.
Gutta Percha & Rubber, Ltd., Toronto.
MacKinnon Steel Co., Sherbrooke, Que

PARTITIONS, WIRE

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Garlock-Walker Machinery Co., Toronto
Hamilton Co., Ltd., Wm., Peterbrough, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

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Garlock-Walker Machinery Co., Toronto
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Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.

PATTERN MAKERS' LATHES

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Clipper Belt Lacer Co., Grand Rapids.

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McDougall Co., R., Galt.
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Williams Tool Corp. of Can. Ltd., Brantford, Ont.

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Wells Bros. of Canada, Galt, Ont.

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Wells Bros. of Canada, Galt, Ont.

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Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. of Canada, Galt, Ont.

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Wells Bros. of Canada, Galt, Ont.

PIPE WRENCHES

Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

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Gardner & Son, Robt., Montreal.
Garlock-Walker Machinery Co., Toronto
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Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
Herbert, Ltd., Alfred, Toronto, Ont.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William, Toronto.
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Williams Mchy Co. Ltd., A. R., Montreal

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Niles-Bement-Pond Co., New York.
Sturtevant Co., B. F., Galt, Ont.

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Rice Lewis & Son, Toronto, Ont.

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Curtis Pneumatic Machy. Co., St. Louis
Garlock-Walker Machy. Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Chicago.
Int. Mach. & Supply Co., Ltd., Montreal
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Niles-Bement-Pond Co., New York.
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Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co, Toledo.

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Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Machy. Co., A. R., Toronto.

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MacKinnon Steel Co., Sherbrooke, Que.

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Pratt & Whitney Co., Dundas, Ont.
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Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams Mchy Co., A. R., Toronto, Ont.

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Brown, Boggs Co., Ltd, Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Buffalo, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams, Ltd., Edinburgh, Scotland.
Bertrams & Sons, John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton, Ont.
Garlock-Walker Mach'y. Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHES, HAND
Niles-Bement-Pond Co., New York.

PYROMETERS
Bristol Co., Waterbury, Conn.
Shore Instrument & Mfg. Co., New York.
Taylor Instrument Co., Rochester, N.Y.

QUARTERING MACHINES
Bertram & Sons, John, Dundas, Ont.
Niles-Bement-Pond Co., New York.

RAIL BENDERS
Algoma Steel Corp., Sault Ste. Marie, Ont.

RAILROAD TOOLS
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

RASPS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

RAWHIDE PINIONS (See Gears)

REAMERS
Butterfield & Co., Inc., Rock Island, Que.

REAMERS, ADJUSTABLE
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.
J. A. M. Taylor, 318 Stair Bldg., Toronto.
Wells Bros. of Can., Galt, Ont

REAMERS, BRIDGE, EXPANDING AND HIGH SPEED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Aikenhead Hardware Co., Toronto.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Gisholt Machine Co., Madison, Wis.
Lyman Tube & Supply Co., Montreal, Que
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Samuel Osborne, Ltd., Montreal, P.Q.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, STEEL TAPER AND SELF-FEEDING
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, CHUCKING
Ackworthie Ltd., J., Birmingham, Eng.
Atkins & Co., Ltd., Wm., Sheffield, Eng
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. of Canada, Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, HAND
Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, PIN
Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Greenfield.
Morrow Screw & Nut Co., John, Ingersoll
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMER FLUTING MACHINES
Garvin Machine Co., New York.

REAMING MACHINES, PNEUMATIC
Cleveland Pneumatic Co. of Can., Toronto
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.

RECORDING INTRUMENTS
Bristol Co., Waterbury, Conn.
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Rochester, N.Y.

REELS, WIRE AND TEXTILE MFG
American Pulley Co., Philadelphia, Pa.

REGULATORS, AUTOMATIC
Electric Steels & Metals, Ltd., Welland

REGULATORS, PRESSURE, TEMPERATURE
Can. Fairbanks-Morse Co., Montreal.
Taylor Instrument Co., Rochester, N.Y.

REPAIR WORK — SAWS
Atkins & Co., E. C., Hamilton, Ont.

REPAIR WORK, ALL KINDS
Elec. Steel & Metals, Welland, Ont.

RIVETS.
Aikenhead Hardware Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque.
Rice, Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.

RIVETERS, PNEUMATIC, HYDRAULIC, HAMMER, COMPRESSION
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

RIVETING MACHINES, ELASTIC, ROTARY BLOW
High-Speed Hammer Co., Rochester.
Petrie, Ltd., H. W., Toronto.
F. B. Shuster Co., New Haven, Conn.
Strelinger Co., C. A., Windsor, Ont.

ROAD BUILDING EQUIPMENT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke.
Holden Co., Ltd., Montreal, Que.

ROAD-MAKING MACHINERY
G. F. Foss Mchy & Sply. Co., Montreal.

RODS, PURE NICKEL, MONEL METAL, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville.

ROLLER CHAINS
Can. Link-Belt Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que
Renold of Canada Ltd., Montreal.

ROLLS, BENDING, STRAIGHTENING
John Bertram & Sons Co., Dundas.
Brown, Boggs Co., Ltd., Hamilton.
Can. Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo, O.

ROLLS CRUSHING
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

ROLLS AND TABLES
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Elec. Steel & Metals, Welland, Ont.

ROOFING
H. H. Robertson, Ltd., Sarnia, Ont.

ROPE, GALV. MONEL METAL, BRONZE, TILLER AND SASH CORD
Can. Driver-Harris Co., Ltd., Walkerville

ROLLING MACHINES, SHEET METAL
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLING MILL MACHINERY
Dom. Steel Products Co., Ltd. Brantford
Mesta Machine Co., Pittsburgh, Pa.

ROLL LATHES
Mesta Machine Co., Pittsburgh, Pa.

ROLLS, BENDING, STRAIGHTENING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLS, CRUSHING
Can. Link-Belt Co., Toronto.

ROOF COOLERS
Electric Steels & Metals, Ltd., Welland

RUBBER MILL DRIVES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford.
Can. Link-Belt Co., Toronto.

RUBBER MILL MACHINERY
Bertrams Ltd., Edinburgh, Scotland.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford.

RUBBER MOULDS & CORES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

RUBBER PRODUCTS, MECHANICAL
Dunlop Tire & Rubber Goods Co., Ltd., Montreal.

RUBBING BRICKS
Dominion Abrasive Co., Mimico, Ont.

RULES
Brown & Sharpe Mfg. Co., Providence.
James Chesterman & Co., Ltd., Sheffield.
Rice, Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N.Y.

SAW MILL CONVEYORS
Can. Link-Belt Co., Toronto.
Petrie, Ltd., H. W., Toronto.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.

SAND MIXING MACHINERY
Frost Mfg. Co., Chicago, Ill.

SANITARY DRINKING FOUNTAINS
Pure Sanitary Drinking Fountain Co., Haydenville.

SANDING MACHINES
Canada Machinery Corp., Galt.

SAW MILL MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt.
Robert Gardner & Son, Montreal.
Curtis Pneumatic Machy Co., St. Louis
Hamilton Co., Ltd., Wm., Peterborough, Ont.
A. R. Williams Machy. Co., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

SASH SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

SAWS FOR EVERY USE
Atkins & Co., E. C., Hamilton, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., E. C., Hamilton, Ont.
Cochrane-Bly Co., Rochester, N.Y., U.S.A.
Wm. Atkins & Co., Ltd., Sheffield, Eng
Marshal, Son & Bunney, Toronto.
Simonds Mfg. Co., Fitchburgh, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

SAWS, HACK (See Hack Saws)

SAW GUARDS
Ackworthie Ltd., J., Birmingham, Eng.
Atkins & Co., E. C., Hamilton, Ont.
Clemson Bros. Inc., Hamilton, Ont.

SAWING MACHINES, METAL
Herbert, Ltd., Alfred, Toronto, Ont.

SAWING MACHINES, CIRCULAR, FOR COLD METAL
Cochrane-Bly Co., Rochester, N.Y., U.S.A.

SAWS, METAL, HACK AND BAND
Atkins & Co., E. C., Hamilton, Ont.
Clemson Bros. Inc., Hamilton, Ont.

SAWS, SILVER STEEL
E. C. Atkins & Co., Inc., Indianapolis

SAW SHARPENERS
Cochrane-Bly Co., Rochester, N.Y., U.S.A.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Can., Galt, Ont.

SAWS, SLITTING
J. A. M. Taylor, Stair Bldg., Toronto.
Atkins & Co., E. C., Hamilton, Ont.

SAWS — HIGH-SPEED FRICTION
Atkins & Co., E. C., Hamilton, Ont.

SAWS — PATTERN SHOP
Atkins & Co., E. C., Hamilton, Ont.

SAWS — SWING
Atkins & Co., E. C., Hamilton, Ont.

SCLEROSCOPES
Shore Instrument & Mfg. Co., New York

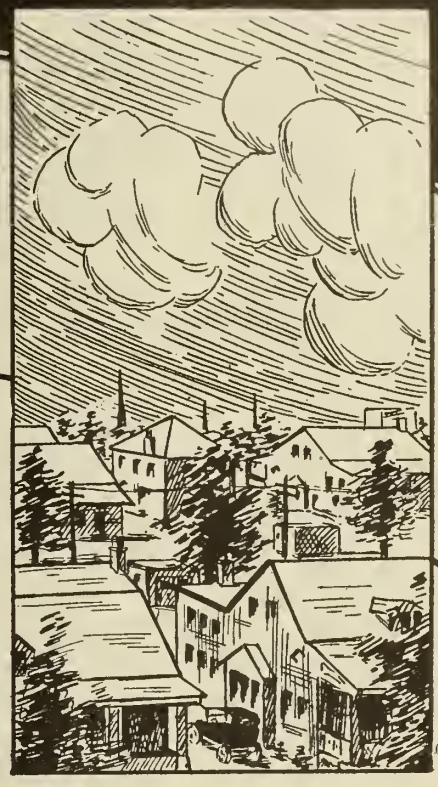
SCREENING MACHINERY
Can. Link-Belt Co., Toronto.

SCREW EXTRACTORS
Cleveland Twist Drill Co., Cleveland.

SCREW MACHINES, HAND, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Ltd., Toronto
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
Herbert, Ltd., Alfred, Toronto, Ont.
A. B. Jardine & Co., Hespeler.
National Acme Co, Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Warner & Swasey Co., Cleveland, O.
Wells Bros. of Can., Galt, Ont.

The Mecca of Manufacturers

ST. JOHNS QUEBEC

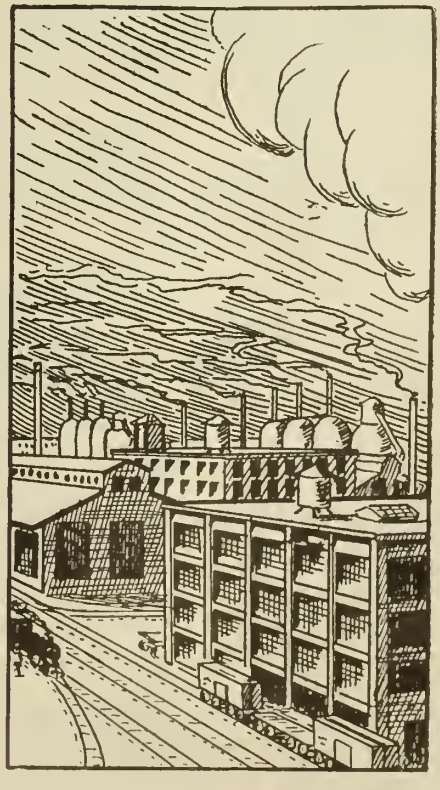


Consider Its Advantages!

ST. JOHNS possesses such unusual advantages of great economic importance, such as its commanding geographical location, unequalled transportation facilities, adequate fuel, power and labour supply, that it should always be included in investigations before definitely deciding on the location of a new industry. Situated on the Richelieu River, in the most densely populated section of Quebec, **and being the nerve centre for a network of seven important railways,** St. Johns obtains lower freight rates and cheaper fuel and labour than any other centrally-located manufacturing city on the North American Continent.

St. Johns is directly connected by rail with the Montreal docks, 27 miles distant, affording first-class facilities for foreign trade. Excellent canals connect with St. Lawrence and also with New York and the Eastern States.

Electric power is cheap and plentiful and the excellent railway connections assure a satisfactory coal supply. In addition to the natural advantages of St. Johns as an industrial site the city also offers extraordinary inducements, such as : Tax exemptions; street extensions; bonus of five per cent. on your payroll for five years, making it an unusual industrial opportunity.



For Specific Information
Write to

The Secretary of the City Council
ST. JOHNS, QUE.

If interested tear out this page and place with letters to be answered.

SCREWS, MACHINE, SET, CAP AND SPECIAL
Galt Machine Screw Co., Galt.
John Morrow Screw & Nut Co., Ingersoll.
National Acme Co., Montreal.
Rice Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.

SCREW COLLARS
Galt Machine Screw Co., Ltd., Galt, Ont.
John Morrow Screw & Nut Co., Ingersoll.

SCREW MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence, R.I.
Herbert, Ltd., Alfred, Toronto, Ont.

SCREW PLATES
Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto.
J. A. M. Taylor, Stair Bldg., Toronto.
Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton.

SCREWS, SAFETY SET
Galt Machine Screw Co., Ltd., Galt, Ont.

SCREW SLOTTERS
Butterfield & Co., Inc., Rock Island, Que.
Garvin Machine Co., New York.
National Acme Co., Cleveland, O.
Pratt & Whitney Co., Dundas, Ont.

SELF-OPENING DIES
See Dies.

SET SCREWS, SAFETY
Aikenhead Hardware Co., Toronto.
Bristol Co., Waterbury, Conn.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wilkinson & Kompass, Hamilton.

SHANKS, STRAIGHT AND TAPER
Jacobs Mfg. Co., Hartford, Conn.

SHAPERS
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt.
Cochrane-Bly Co., Rochester, N.Y., U.S.A.
Geo. F. Foss Mchy. & Sply. Co., Montreal
Robt. Gardner & Son, Montreal.
Garlock-Walker Mach'y. Co., Toronto.
Herbert, Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
Standard Equipment & Tool Wks., Montreal.
Walcott Lathe Co., Jackson, Mich.
Williams Mchy Co., A. R., Toronto, Ont.

SHAPERS, GEAR
Fellows Gear & Shaper Co., Springfield, V.

SHAFTING
Algoma Steel Corp., Sault Ste. Marie, O.
Can. Fairbanks-Morse Co., Montreal.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glassco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

SHARPENING STONES
Norton Co. of Canada, Ltd., Hamilton, Ont.
Norton Co, Worcester, Mass.
Rice, Lewis & Son, Toronto.

SHEARING MACHINES, ANGLE IRON, BAR AND GATE
John Bertram & Sons Co., Dundas.
Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

SHEARS, POWER
John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Strelinger, Chas. A. Co., Windsor, Ont.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co., A. R., Toronto, Ont.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio.

SHEARS, PLATE CUTTING, SLITTING
Dom. Steel Products Co., Ltd., Brantford.

SHEARS, SPLITTING
Dom. Steel Products Co., Ltd., Brantford.

SHEARS, IRREGULAR AND CIRCLE CUTTING
D. H. Stoll Co., Inc., Buffalo, N.Y

SHEARS, SQUARING
Brown, Boggs & Co., Hamilton, Ont.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING MACHINERY
Herbert, Ltd., Alfred, Toronto, Ont.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING TOOLS
Baird Machine Co., Bridgeport, Conn.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Inc., Buffalo, N.Y.
Strelinger, Chas. A. Co., Windsor, Ont.

SHEETS, CRUCIBLE, CAST
British Smelting & Refining Co., Ltd., Montreal, Que.

SHEETS, BLACK AUTO AND GALVANIZED
Peckovers, Ltd., Toronto, Ont.

SHEETS, NICKEL, RESIST. ALLOY
Can. Driver-Harris Co., Ltd., Walkerville.

SHELVING, STEEL
Dennis Wire & Iron Works, London.

SHIPYARD MACHINERY, SHOP FURNITURE
Dennis Wire & Iron Works, London.

SIDE TOOLS
Armstrong Bros. Tool Co., Chicago.
J. H. Williams & Co., Brooklyn, N.Y.

SILENT CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
Renold of Canada Ltd., Montreal.

SLEDGES
Aikenhead Hardware Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont

SLINGS, CHAINS
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

SLOTTERS
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Herbert, Ltd., Alfred, Toronto, Ont.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York

SMOKESTACKS
William Hamilton Co., Peterboro, Ont.
MacKinnon Steel Co., Sherbrooke, Que

SNIPS, TINNERS AND SHEET METAL WORKERS
Kearney & Trecker Co., Milwaukee, Wis
J. Morrow Screw & Nut Co., Ingersoll, Ont

SOCKETS
Brown & Sharpe Mfg. Co., Providence
Butterfield & Co., Inc., Rock Island, Que
Cleveland Twist Drill Co., Cleveland
J. Morrow Screw & Nut Co., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

SOIL PIPE FITTINGS, CAST IRON
Katie Foundry, Galt, Ont.

SOLDERING IRONS
Aikenhead Hardware Co., Toronto, Ont.
Brown, Boggs & Co., Hamilton, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

SOLDER
British Smelting & Refining Co., Ltd. Montreal, Que.
Aikenhead Hardware Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Hoyt Metal Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.

SPELTER
British Smelting & Refining Co., Ltd. Montreal, Que.

SPEED REDUCING GEARS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

SPRINGS, MACHINERY
Barnes, Wallace Co., Bristol, Conn.
Can. Steel Foundries, Ltd., Montreal
Cleveland Wire Spring Co., Cleveland.
Dunbar Bros. Co., Bristol, Conn.
Garlock-Walker Machinery Co., Toronto

SPECIAL MACHINERY
Baird Machine Co., Bridgeport, Conn.
Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Brown Engineering Corp., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford
Ford-Smith Machine Co., Hamilton, Ont
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
Globe Engineering Co. Ltd., Hamilton
Hamilton Co., Ltd., Wm., Peterborough
A. B. Jardine & Co., Hespeler, Ont.
Katie Foundry, Galt, Ont.
Ker & Goodwin Machine Co., Ltd. Brantford, Ont.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
National-Acme Co., Cleveland, Ohio.
Mesta Machine Co., Pittsburgh, Pa.
Stoll Co., D. H., Buffalo, N.Y.
Victoria Foundry Co., Ottawa, Ont.
William R. Perrin, Ltd. Toronto.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

SPECIAL TOOLS, MACHINERY
Crescent Machine Co., Ltd., Montreal. Que.
McClean Machine & Tool Co., Ltd., Hamilton, Ont.

SPOT FACERS, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

SPRING COILING AND WINDING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.

SPRING MAKING MACHINERY (AUTOMATIC)
Baird Machine Co., Bridgeport, Conn.

SPRINGS, SPIRAL, TOOL
The Dunbar Bros. Co., Bristol, Conn.

SPRINGS STEEL
Barnes Co., Wallace, Bristol, Conn.

SPROCKETS, COMPENSATING
Morse Chain Co., Ithaca, New York.

SPROCKETS, SPRING
Morse Chain Co., Ithaca, New York.

SPROCKETS, CHAIN
Can Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia
Renold of Canada Ltd., Montreal.

SPRINGS FOR TOYS AND ELECTRIC DEVICES
The Dunbar Bros. Co., Bristol, Conn.

SPROCKET WHEELS, CAST
Can. Link Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

SANDERS
Oliver Mach. Co., Grand Rapids, Mich.

SAW BENCHES
Oliver Mach. Co., Grand Rapids, Mich.

SAW GUARDS
Oliver Mach. Co., Grand Rapids, Mich.

SAWING MACHINES
Herbert Ltd., Alfred, Toronto, Ont.

SAWS SWING
Oliver Mach Co., Grand Rapids, Mich

SMALL TOOLS
Herbert Ltd., Alfred, Toronto, Ont.

STAYBOLT TOPS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

STAIRS, IRON
Canada Wire & Iron Goods Co., Hamilton, Ont.

STAMPINGS, SHEET BRASS, COPPER, ALUMINUM AND STEEL
Dom. Forge & Stamping Co., Walkerville
Globe Engineering Co., Hamilton, Ont.

STAMPING MACHINERY
Bliss, E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.
Canada Machinery Corp., Galt, Ont.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

STEAM APPLIANCES
Darling Bros., Ltd., Montreal, Quebec.

STEAM SEPARATORS AND TRAPS
Can. Fairbanks-Morse Co., Montreal.

STEAM TURBINES
General Combustion Co., Ltd., Montreal. Que.
Sturtevant Co., B. F., Galt, Ont.

STEEL BALLS
See Balls Steel.

STEEL, CRUCIBLE TOOL
Atkins & Co., Ltd., Wm. Sheffield, Eng
Illingworth Steel Co., John, New York
Marshall, Son & Bunney, Toronto.

STEEL, CARBON, FERRO-TUNGSTEN
Armstrong, Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng
Firth & Sons, Thos., Montreal, Que
Latrobe Electric Steel Co., Latrobe, Pa
Lincoln Electric Co. of Canada, Ltd Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Peckovers, Ltd., Toronto, Ont.
Samuel Osborne (Can.), Ltd., Montreal
Vanadium-Alloys Steel Co., Pittsburgh

STEEL, CHROME MOLYBDENUM
United Alloy Steel Corp., Canton, Ohio.

STEEL CHROME VANADIUM
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm. Sheffield, Eng
Marshall, Son & Bunney, Toronto
United Alloy Steel Corp., Canton, Ohio.

STEEL CHROME NICKEL
Firth & Sons, Ltd., Thos., Montreal.
Lyman Tube & Supply Co., Ltd., Montreal
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng
Marshall, Son & Bunney, Toronto
United Alloy Steel Corp., Canton, Ohio.

STEEL CASTINGS
Can. Elec. Steel Casting Co., Aurora, Ont
Davidson Mfg. Co., Ltd., Montreal, Que
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Dom. Iron & Steel, Sydney, N.S.
Kennedy & Sons, Wm., Owen Sound
Electric Steel & Metals Co., Welland.
Nova Scotia Steel & Coal Co., Windsor
Swedish Crucible Steel Co., Windsor

STEEL, COLD DRAWN
United Alloy Steel Corp., Canton, Ohio.

STEEL, COLD ROLLED
Atkins & Co., Ltd., Wm., Sheffield, Eng
Can. Drawn Steel Co., Hamilton, Ont
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont

STEEL, ELECTRIC FURNACE
United Alloy Steel Corp., Canton, Ohio.

STEEL FJAB
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.

STEEL, NICKEL
Atkins & Co., Ltd., Wm., Sheffield, Eng
Marshall, Son & Bunney, Toronto.
United Alloy Steel Corp., Canton, Ohio.

STEEL, HIGH SPEED
Armstrong-Whitworth of Can., Montreal
Wm. Atkins & Co., Sheffield, Eng.
Can. Fairbanks-Morse Co., Montreal
Deloro Smelting & Refining Co., Ltd Toronto, Ont.
H. A. Drury Co., Ltd., Montreal.
Firth & Sons, Thos., Montreal, Que.
Illingworth Steel Co., J., New York.
Latrobe Electric Steel Co., Latrobe, Pa
Marshall, Son & Bunney, Toronto, Ont.
Osborne, Samuel, Montreal, P.Q.
Pilot Steel & Tool Co., Montreal, Que
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, OPEN HEARTH
Illingworth Steel Co. John, New York.
United Alloy Steel Corp., Canton, Ohio.

STEEL PLATES
Dominion Foundries & Steel Ltd., Hamilton, Ont.

STEEL PRODUCTS AND MACHINERY
Dom. Steel Products Co., Ltd., Brantford

STEEL, ROCK DRILL
Armstrong, Whitworth of Canada, Montreal, Que.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

STEEL, SPECIAL ANALYSIS
United Alloy Steel Corp., Canton, Ohio.

STEEL, SPRING AND REINFORCING
Peckovers, Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie
MacKinnon Steel Co., Sherbrooke, Que.
Peckovers, Ltd., Toronto, Ont.

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Atkins & Co., Wm., Sheffield, Eng.
Can. Fairbanks-Morse Co., Montreal
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Co., H. A., Montreal, Que.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Firth & Sons, Thos., Montreal, Que
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont.
Latrobe Electric Steel Co., Latrobe, Pa.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL TUBING
Tube Co. of Canada, Ltd., Toronto, Ont.

STEEL, VANADIUM
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Armstrong, Whitworth of Can., Montreal.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Drury, H. A., Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Vanadium-Alloys Steel Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

"STELLITE"
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Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

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Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.

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Rice Lewis & Son, Toronto, Ont.
Wells Bros., Co., of Canada, Galt, Ont.

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Page Steel & Wire Co., Adrian, Mich.

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William Hamilton Co., Peterboro, Ont.

SWITCHBOARDS
Can. Steel Foundries, Ltd., Montreal.

SWITCHES, RAILWAY
Northern Electric Co., Ltd., Montreal Que

THE GARVIN PAGE

Published by

THE GARVIN MACHINE CO.

Builders of Machine Tools since 1865

About our purposes

From now on we will meet you here from week to week. We are not going to be formal but want to make this an opportunity to pass along some of the chance thoughts that occur to us.

We are proud of the 55 years record of achievement behind us, of the good friends we have made and kept through those years, but we aren't old fogyish. The House of Garvin is on its toes all the time, up and coming, with the same ideal of service, but with new ideas of how to make that service effective.

We know we are human; we want you to realize it, we want you to think of us as more than builders of machine tools which come to you in a crate and for which you mail a check. When some little machinery problem confronts you, just say to yourself. "There's Garvin—they must have met this same thing sometime—guess I'll ask them."

See how quick we answer—just see.

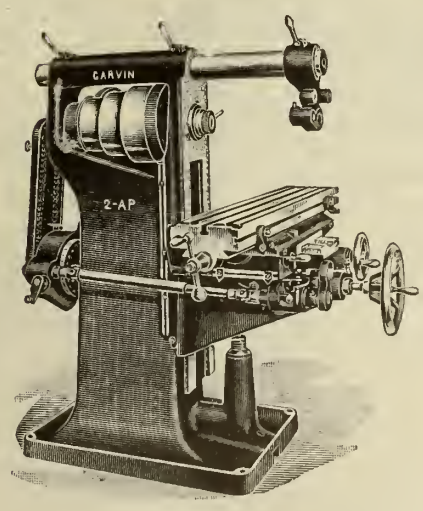
H. R. GARVIN.

About the Company's Milling Machines

A man asked us the other day, how long a life a Garvin Miller would have. We had to tell him we didn't know.

We do know of Garvin Millers that have been working upwards of twenty years. But machine tool life is too much affected by all sorts of conditions to make any positive predictions.

We do know we build Garvin Millers as good as they can be made. We know there are no flaws in their design—time has proven this. We know that the right material is used and that every bit of the workmanship is up to the Garvin Standard.



We say to everyone that we know a Garvin Milling Machine has the in-built capacity to serve long and well—they admit no superior.

Built in a full range of sizes —plain, hand, universal. All described in detail in the Garvin Catalog. Tell us your need.

The Garvin Machine Company

Spring & Varick Sts.
New York, N.Y.

GARVIN

BUILDER OF BETTER MACHINE TOOLS

If interested tear out this page and place with letters to be answered.

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Economy Drawing Table Co., Adrian, Mich.

TAPPING MACHINES (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

TANKS, AIR, EXPANSION
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, GASOLINE, KEROSENE AND OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville.
MacKinnon Steel Co., Sherbrooke, Que.
Marshall, Son & Bunney, Toronto.

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Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, PNEUMATIC AND CLOSET
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

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Dominion Bridge Co., Montreal, Quebec.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd, Toronto.

TANK WAGONS
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto.

TANKS, WELDED
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Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
William Hamilton Co., Peterboro, Ont.

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Galt Machine Screw Co., Ltd., Galt, Ont.

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Williams Tool Corp. of Can. Ltd., Brantford, Ont.

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Geometric Tool Co., New Haven.
Ingersoll Mach. Co., Ingersoll, Ont.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Pilot Steel & Tool Co., Montreal, Que.
Victor Tool Co., Waynesboro, Pa.

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Wells Bros. of Can., Galt, Ont.

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Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE SCREW
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Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

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Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
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Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

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Morse Twist Drill & Mchy. Co., New Bedford, Mass.
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Taylor, J. A. M., 618 Stair Bldg., Toronto.
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THERMOMETERS, RECORDING AND INDEX
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Taylor Instrument Co., Rochester, N.Y.

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National-Acme Co., Cleveland, Ohio.
National Machy. Co., Tiffin, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt., Ont.

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Landis Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

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Greenfield Tap & Die Corp., Greenfield.
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Wells Bros. Co. of Canada, Galt., Ont.

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See Screws.
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British Smelting & Refining Co., Ltd., Montreal, Que.
Hoyt Metal Co., Toronto, Ont.

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Brown, Boggs & Co., Hamilton, Can.
Petrie, Ltd., H. W., Toronto.

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Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
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Williams & Co., J. H., Brooklyn, N.Y.

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Williams & Co., J. H., Brooklyn, N.Y.

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Herbert Ltd., Alfred, Toronto, Ont.

TOOL ROOM PARTITIONS
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Rice Lewis & Son Toronto, Ont.

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Petrie, Ltd., H. W., Toronto.

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Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Chicago.
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Williams Machy. Co., A. R., Toronto.
U. S. Electrical Tool Co., Cincinnati, O.

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Davidson Tool Mfg. Co., New York, N.Y.
Deloro Smelting & Refining Co., Ltd Toronto, Ont.

TOOLS, LUMBERING
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Williams & Co., J. H., Brooklyn, N.Y.

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Strelinger Co., C. A., Windsor, Ont.

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McClean Machine & Tool Co., Ltd., Hamilton, Ont.
McCrosky Tool Corp., Meadville, Pa., U. S. A.

TORCHES, BLOW
Int. Mach. & Supply Co., Ltd., Montreal.

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Turner Brass Works, Sycamore, Ill.

TORCHES, STEEL
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Prest-O-Lite Co., Inc., Toronto, Ont.

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Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

TRAM RAIL SYSTEMS (Overhead)
Brown Hoisting Machinery Co., Cleveland, Ohio.

TRAMWAYS, BRIDGE
Brown Hoisting Machinery Co., Cleveland, Ohio.

TRANSFORMERS
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Northern Electric Co., Ltd., Montreal.

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Can. Fairbanks-Morse Co., Montreal.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Kennedy & Sons, Wm., Owen Sound, Ont
Morse Chain Co., Ithaca, N.Y.
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Renold of Canada Ltd., Montreal.
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Williams Machinery Co., A. R., Toronto.

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MacKinnon Steel Co., Sherbrooke, Que.
Northern Crane Works, Walkerville.
Tallman Brass & Metal Co., Hamilton.

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Lyman Tube & Supply Co., Ltd., Montreal
Morris Crane & Hoist Co., Ltd., Herbert Niagara Falls, Ont.

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Chapman Double Ball Bearing, Toronto
Cowan Truck Co., Holyoke, Mass.
MacKinnon Steel Co., Sherbrooke, Que.
Rice Lewis & Son, Toronto, Ont.

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Cowan Truck Co., Holyoke, Mass.

TRUCKS, FLOOR
Cowan Truck Co., Holyoke, Mass.

TRUCKS, HAND
Cowan Truck Co., Holyoke, Mass.

TRUCKS, LUMBER AND KILN
Swedish Steel & Importing Co., Montreal
Northern Crane Works, Walkerville.

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Cowan Truck Co., Holyoke, Mass.

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Tube Co. of Can., Ltd., Toronto, Ont.

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Tallman Brass & Metal Co., Hamilton

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Lyman Tube & Supply Co., Montreal, Que

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Lyman Tube & Supply Co., Montreal, Que.

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Tube Co. of Can., Ltd., Toronto, Ont.

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Brown & Sharpe Mfg. Co., Providence.
Garlock-Walker Machinery Co., Toronto
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Pratt & Whitney, Hartford, Conn.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Warner & Swasey Co., The, Cleveland, O

TURBO GENERATOR UNITS
Garvin Machine Co., New York.
Holden Co., Ltd., Montreal, Que.
MacGovern & Co., Montreal, Que.
Warner & Swasey, Cleveland, O.

TURNBUCKLES
Canada Fdry. & Forg Ltd., Welland.
Morrow Screw & Nut Co., Ingersoll, Ont.
Rice Lewis & Son, Toronto, Ont.

TURNTABLES
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Dom. Bridge Co., Ltd., Montreal, P.Q
Elec. Steel & Metals, Welland, Ont.
Morris Crane & Hoist Co., Ltd., Herbert Niagara Falls, Ont.

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Butterfield & Co., Inc., Rock Island, Que

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Ford-Smith Machine Co,. Hamilton, Ont
Garlock-Walker Machinery Co., Toronto.
Jardine & Co., A. B., Hespeler, Ont.
National Machy. Co., Tiffin, O.
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.

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Crane, Ltd., Montreal, Que.

VALVES (IRON) STANDARD AND EXTRA HEAVY
Crane, Ltd., Montreal, Que.

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VALVES, HYDRAULIC
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Williams Machy. Co., A. R., Toronto.

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Williams & Co., J. H., Brooklyn, N.Y

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Foss Machy. & Sply. Co., G. F., Montreal.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Superior Machinery Co., London, Ont.

VISES, DRILL
Superior Machinery Co., London, Ont.

VISES, PIPE
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.
Strelinger, Chas. A. Co., Windsor, Ont.

VISES, MILLING MACHINE
Brown & Sharpe Mfg. Co., Providence, R.I.
Superior Machinery Co., London, Ont.

VISES, PLANER AND SHAPER
Aikenhead Hardware Co., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Superior Machinery Co., London, Ont.

VOLMETERS & AMMETERS
Northern Electric Co., Ltd., Montreal Que

WASHER MACHINES
National Machy. Co., Tiffin, Ohio.

WASHERS
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Barnes, Wallace, Co., Bristol, Conn.
Graton & Knight Mfg. Co., Worcester.
London Bolt & Hinge Wks., London, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

WASTE
Wilkinson & Kompass Hamilton, Ont.

WASTE CLEANER AND OIL RECLAIMER
Oakley Chemical Co., New York, N.Y.

WATER-INTAKE SCREENS
Can. Link-Belt Co., Toronto, Ont.

WATER TOWERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto.

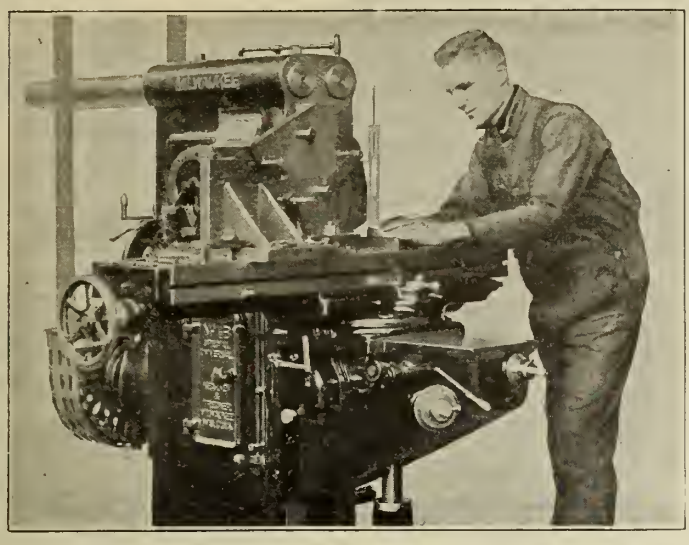
WATER WHEELS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hamilton Co., Ltd., Wm., Peterborough

WELDED TANKS
Can. John Wood Co., Toronto, Ont.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

WELDERS, ELECTRIC ARC
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

WELDING, ELECTRIC, SPOT, BUTT, ETC.
McClean Machine & Tool Co., Ltd., Hamilton, Ont.
Tabor Mfg. Co., Philadelphia, Pa.

WELDING MASKS
Carter Welding Co., Ltd., Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.



Milwaukee Universal Milling Machines

Efficient on Light and Heavy Milling

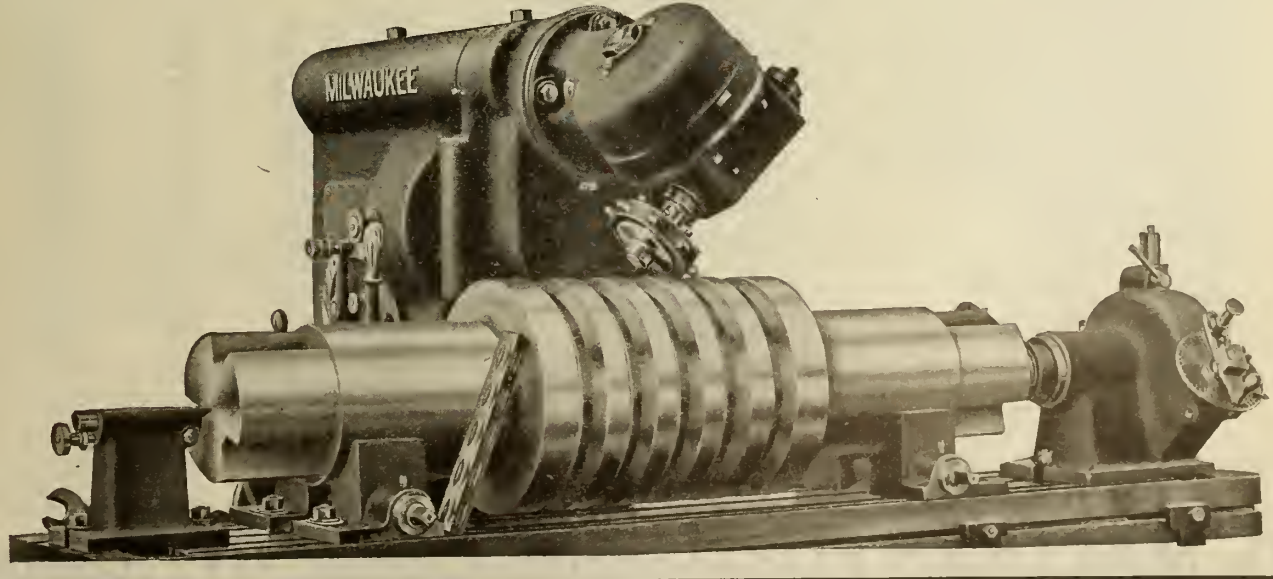
Heavy milling jobs are not unknown to Milwaukee Universal Milling Machines, while delicate and intricate ones are efficiently performed with little effort.

Both light and heavy milling operations are handled with such smoothness and accuracy that the finest results are obtained. Because Milwaukee Universal Milling Machines perform such a wide variety of work, they are particularly well adapted for the tool-room.

The jobs shown in the two illustrations are representative of "Milwaukee" adaptability. The upper illustration shows a jig being bored with a fly cutter. The lower illustrates the milling of a chilled roll with the use of a Universal Milling Attachment.

KEARNEY & TRECKER CO., MILWAUKEE, WIS., U.S.A.

Canadian Representatives: Williams & Wilson, Ltd., Montreal; F. F. Barber Machy. Co., Toronto; A. R. Williams Machy. Co., Vancouver and Winnipeg



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CANADIAN MACHINERY

BUYERS' DIRECTORY

Volume XXIV.

WELDING GOGGLES
Carter Welding Co., Ltd., Toronto, Ont.
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L'Air Liquide Society, Toronto, Ont.
Willson Goggles Inc., Reading, Pa.

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Davis-Bournonville Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.

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L'Air Liquide Society, Toronto, Ont.
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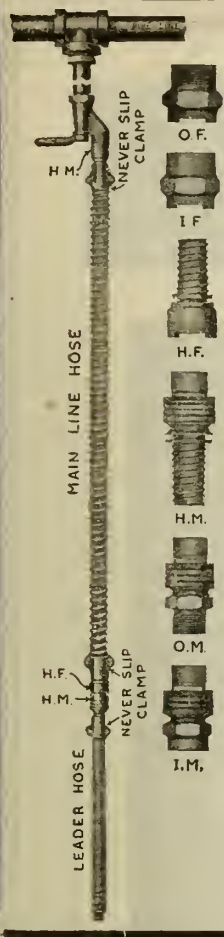
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They are absolutely air-tight under all pressures.
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Grooved Nipples when attached to hose with the wire clamp cannot "blow-out," as one-half of the Wire Clamp lies in Nipple Groove, and the other half on the hose, uniting nipple and hose permanently.

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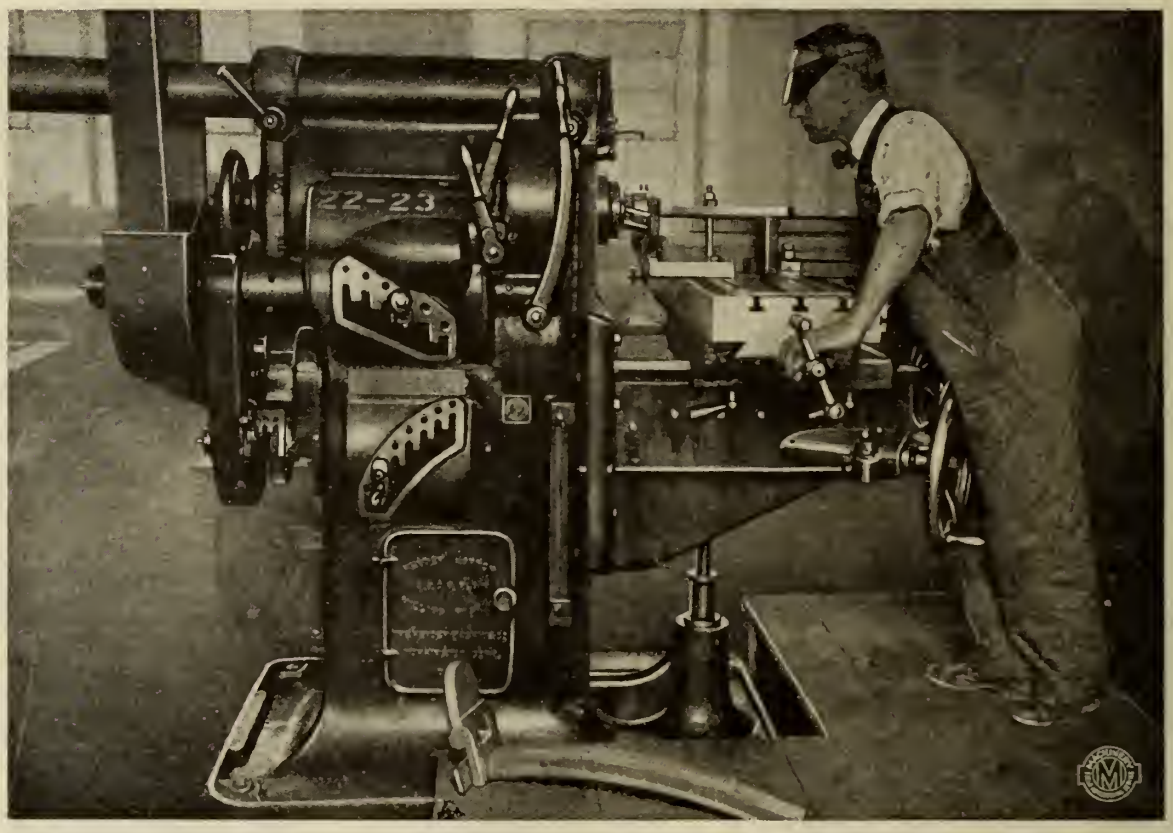
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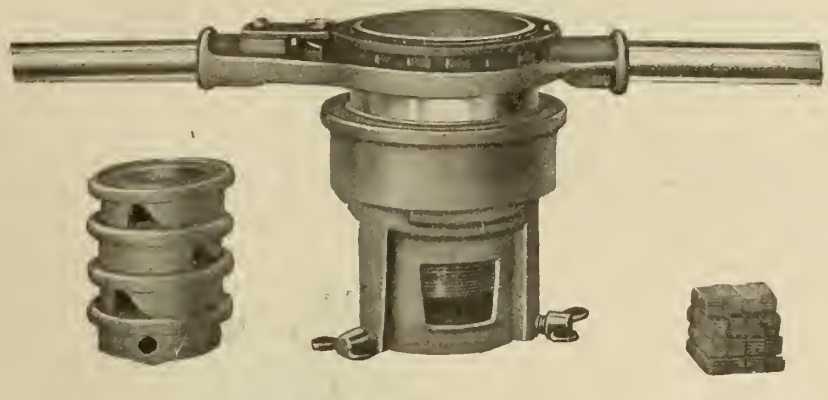
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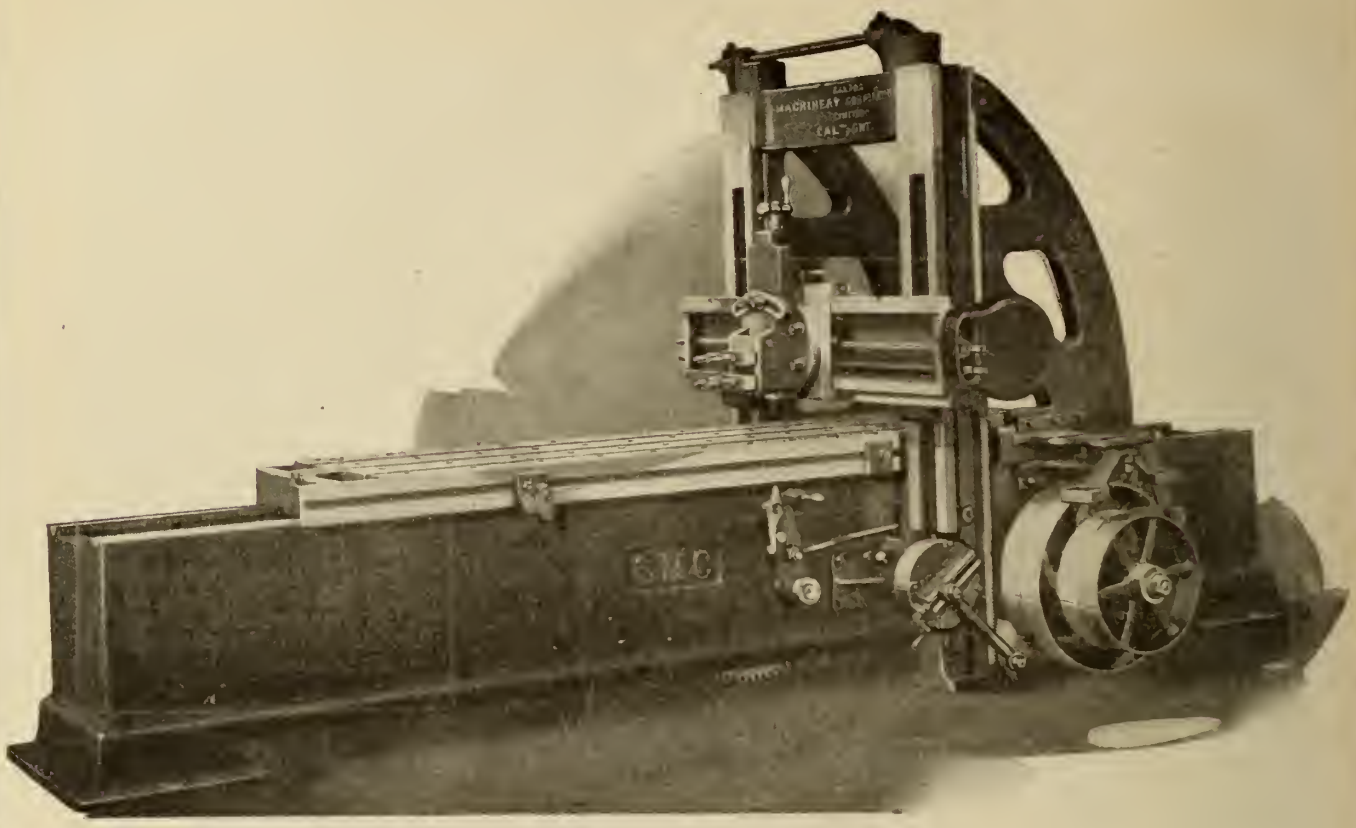
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GALT, ONTARIO

CANADIAN MACHINERY AND MANUFACTURING NEWS

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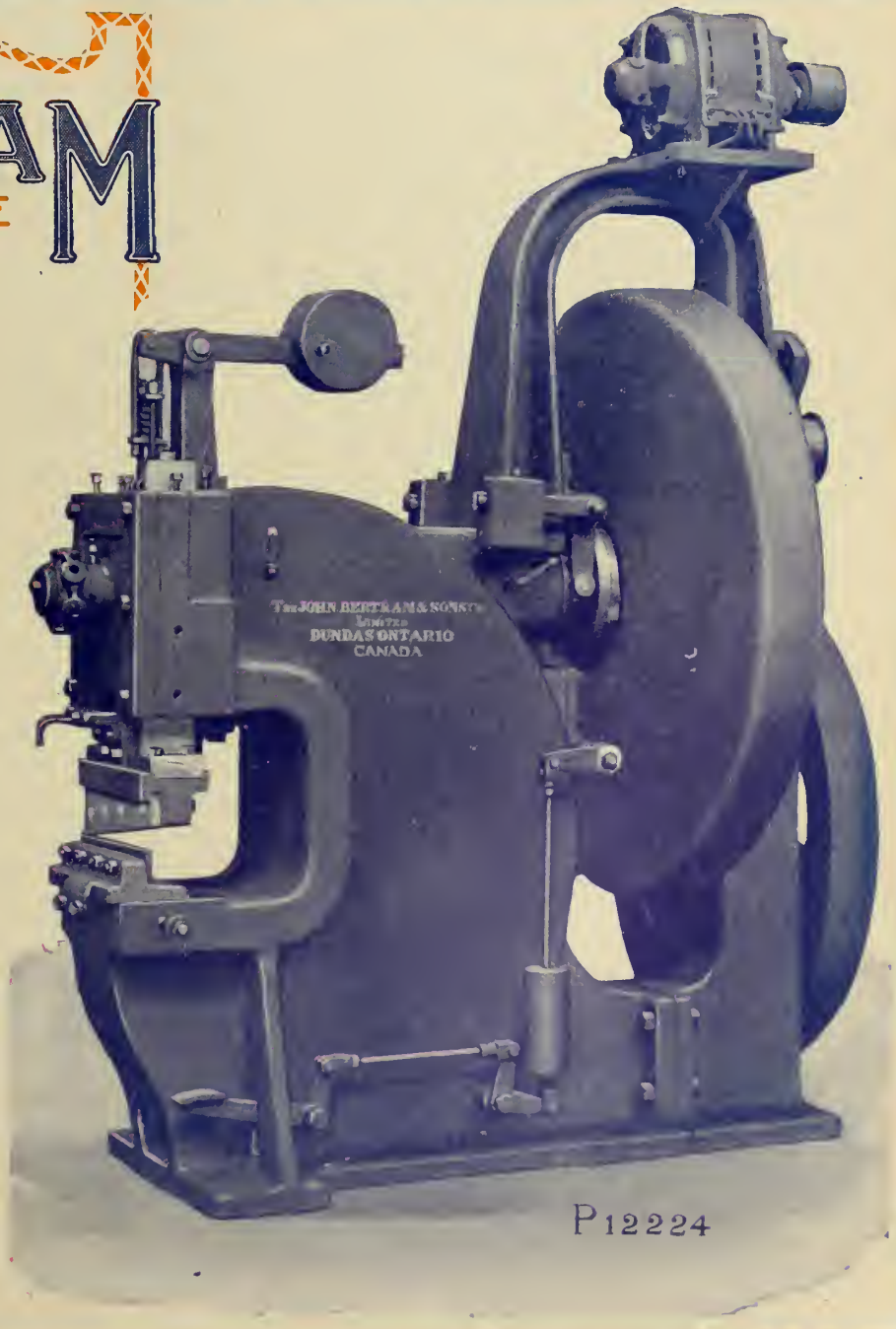
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BERTRAM MACHINE TOOLS

Illustration shows our No. 4 Single Punch and Shear, 12" Throat Motor Drive through belt, fitted with plate shearing attachments.

Capacity

To punch 1" hole through 1" Plate
To shear 1" Plates
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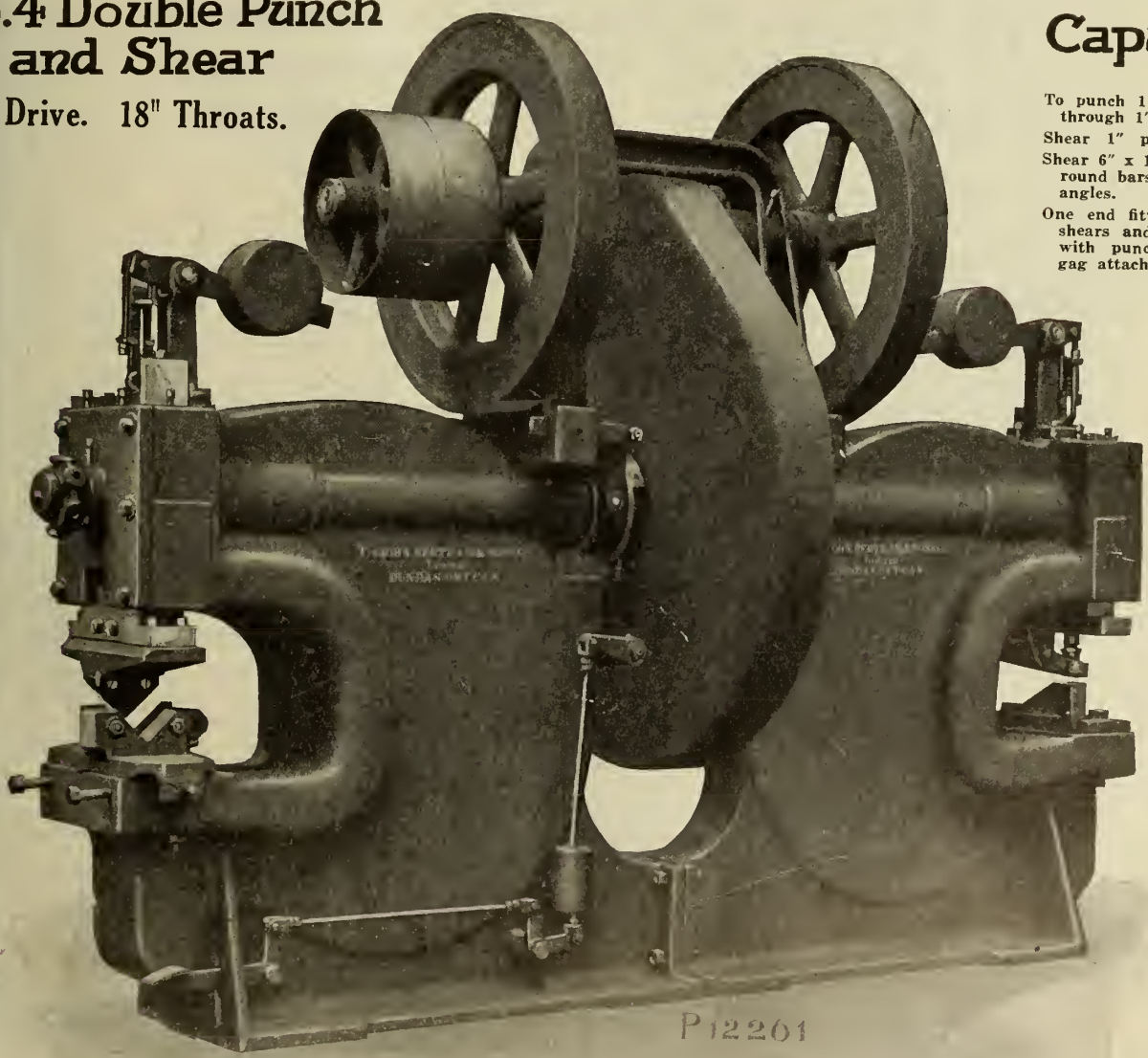
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JOBSCO

No. 4 Double Punch and Shear

Belt Drive. 18" Throats.



Capacity

To punch 1" diameter holes through 1" plate.

Shear 1" plate.

Shear 6" x 1" flat bars, 1¾" round bars, 4" x 4" x ⅜" angles.

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BELTING

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BECAUSE

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GUARANTEE

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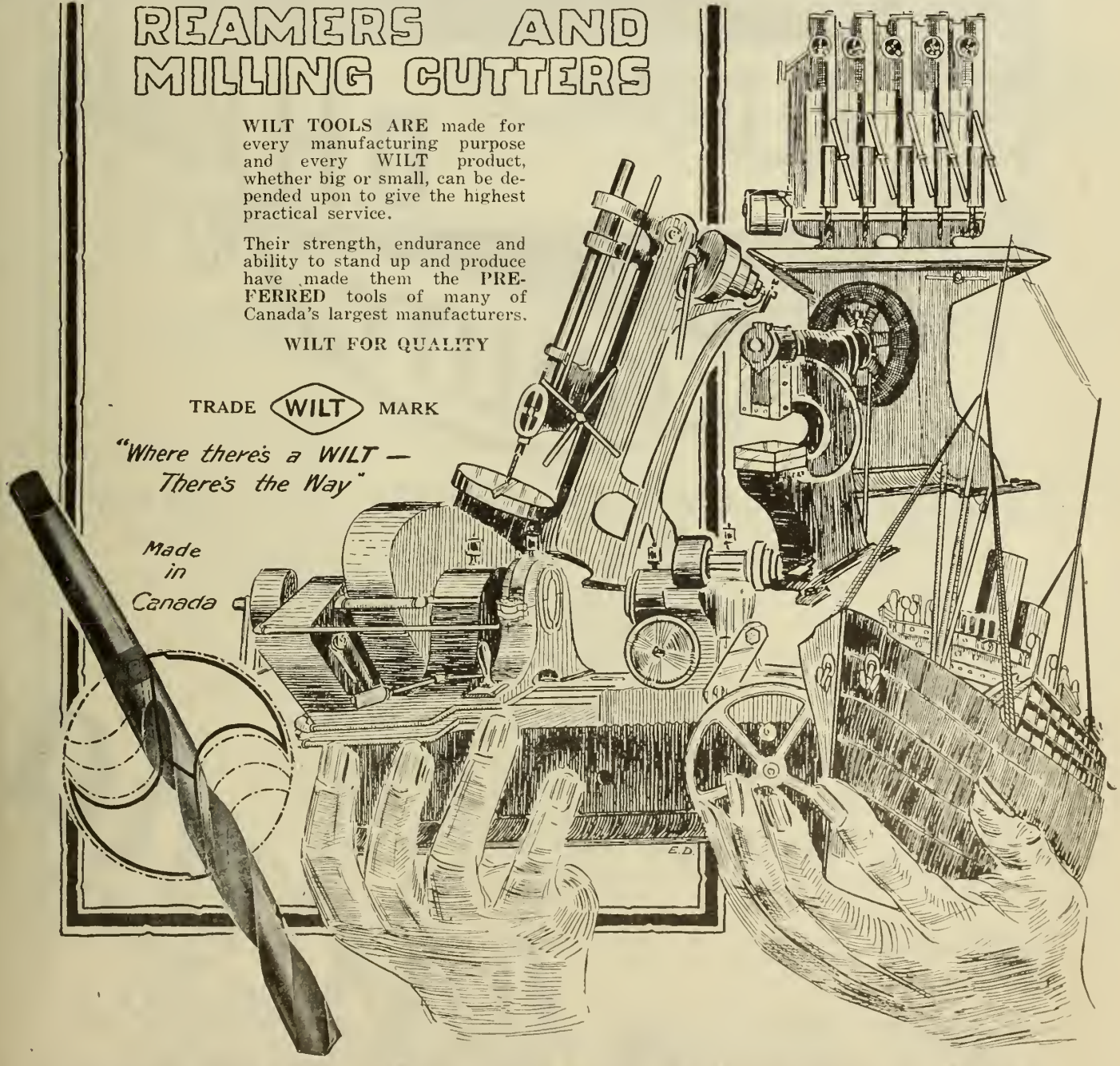
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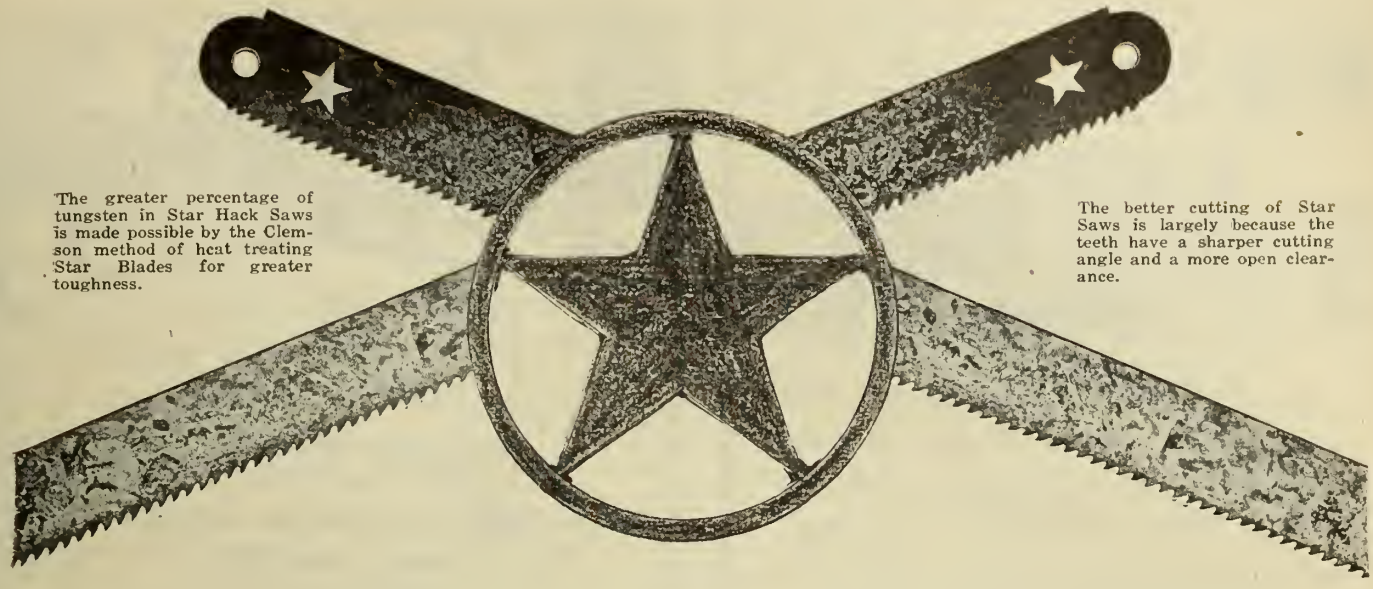
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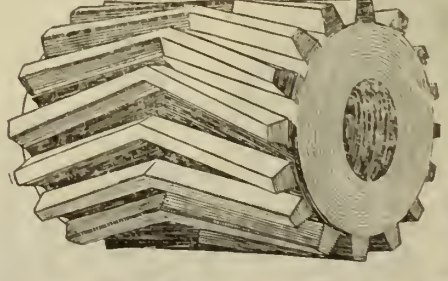
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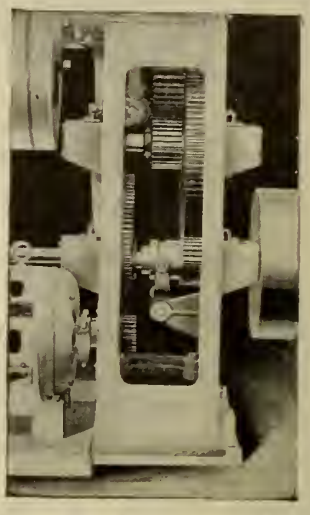
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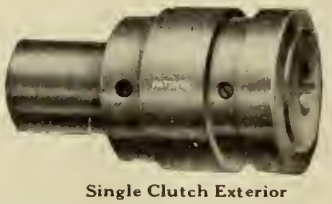
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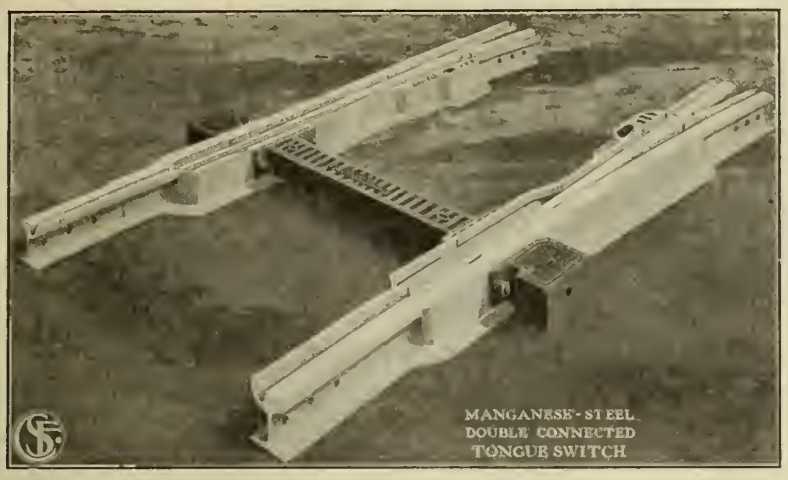
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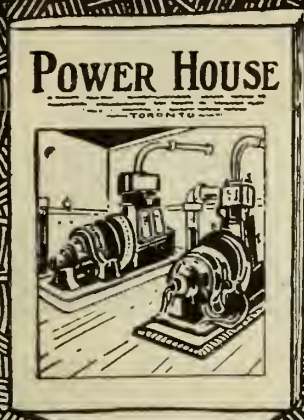
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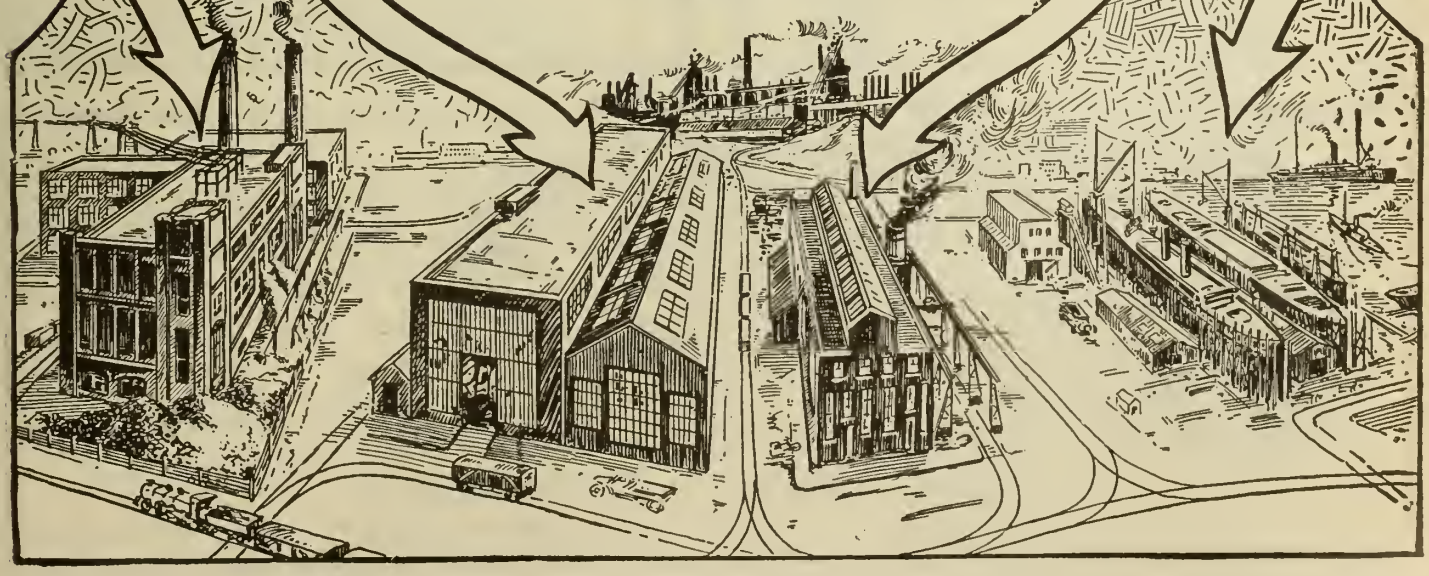
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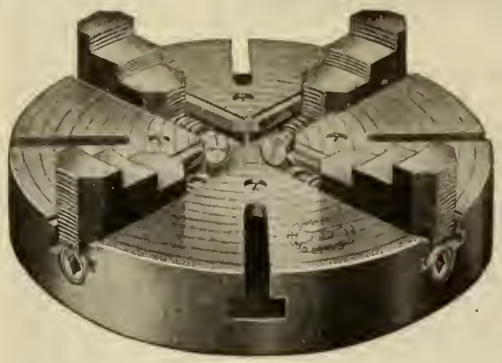
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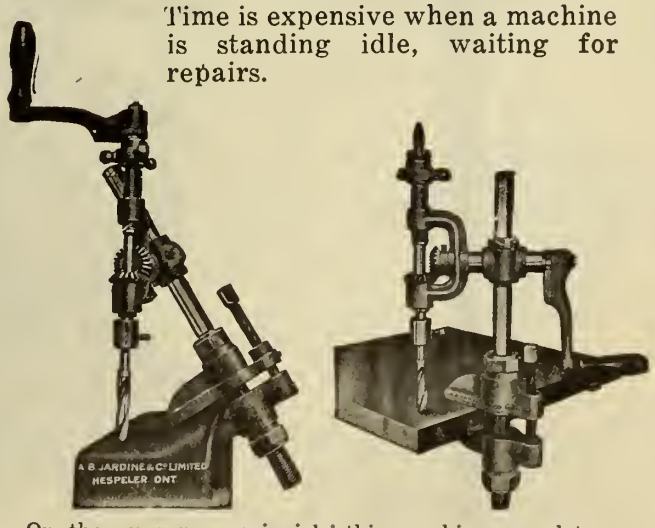
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Time is expensive when a machine is standing idle, waiting for repairs.



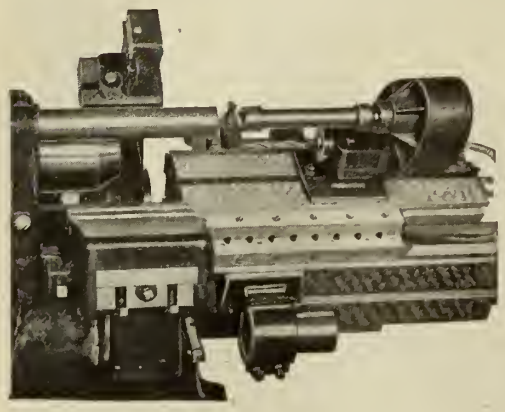
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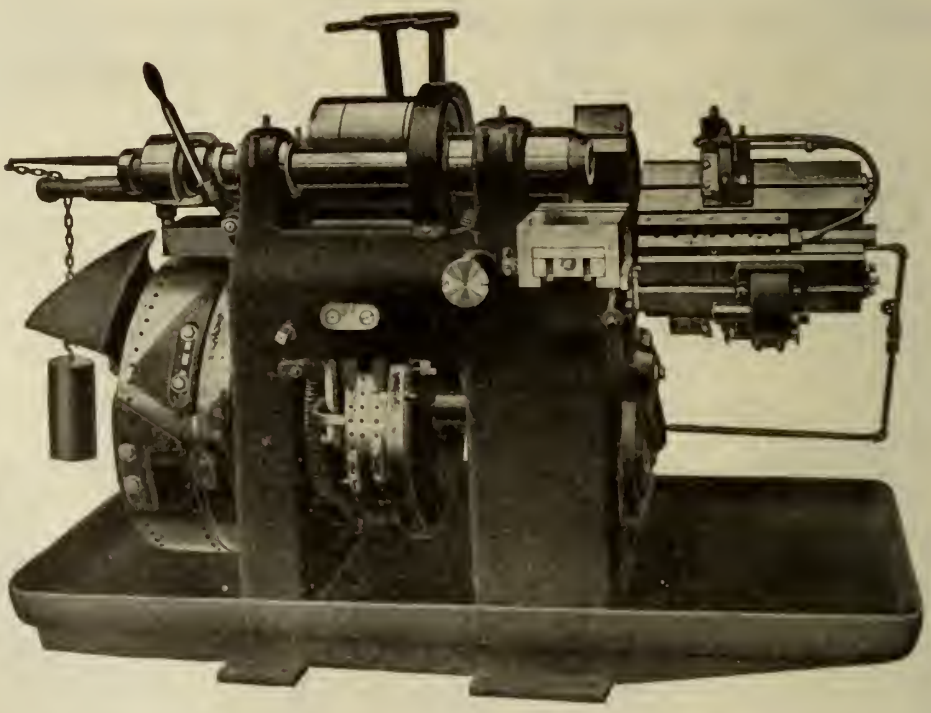


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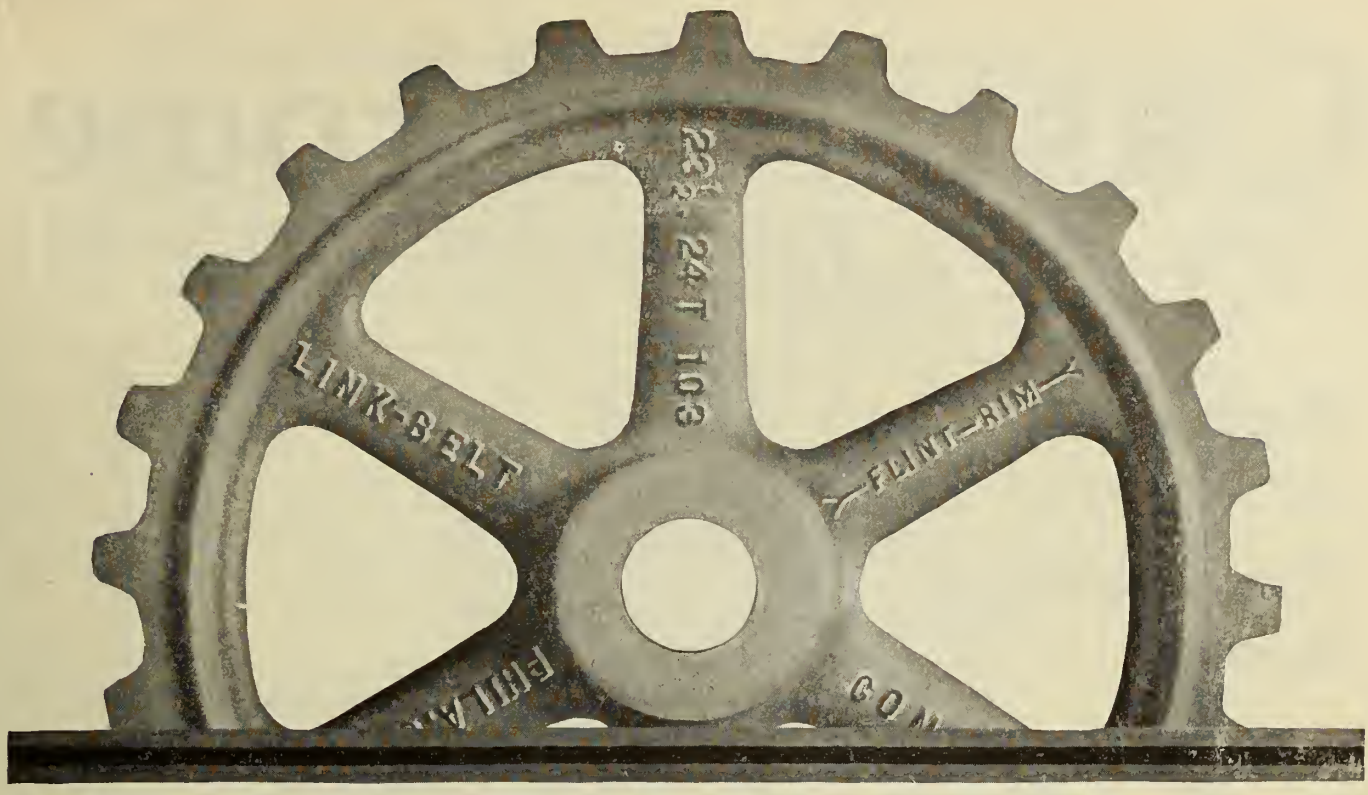
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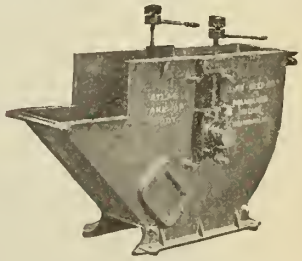
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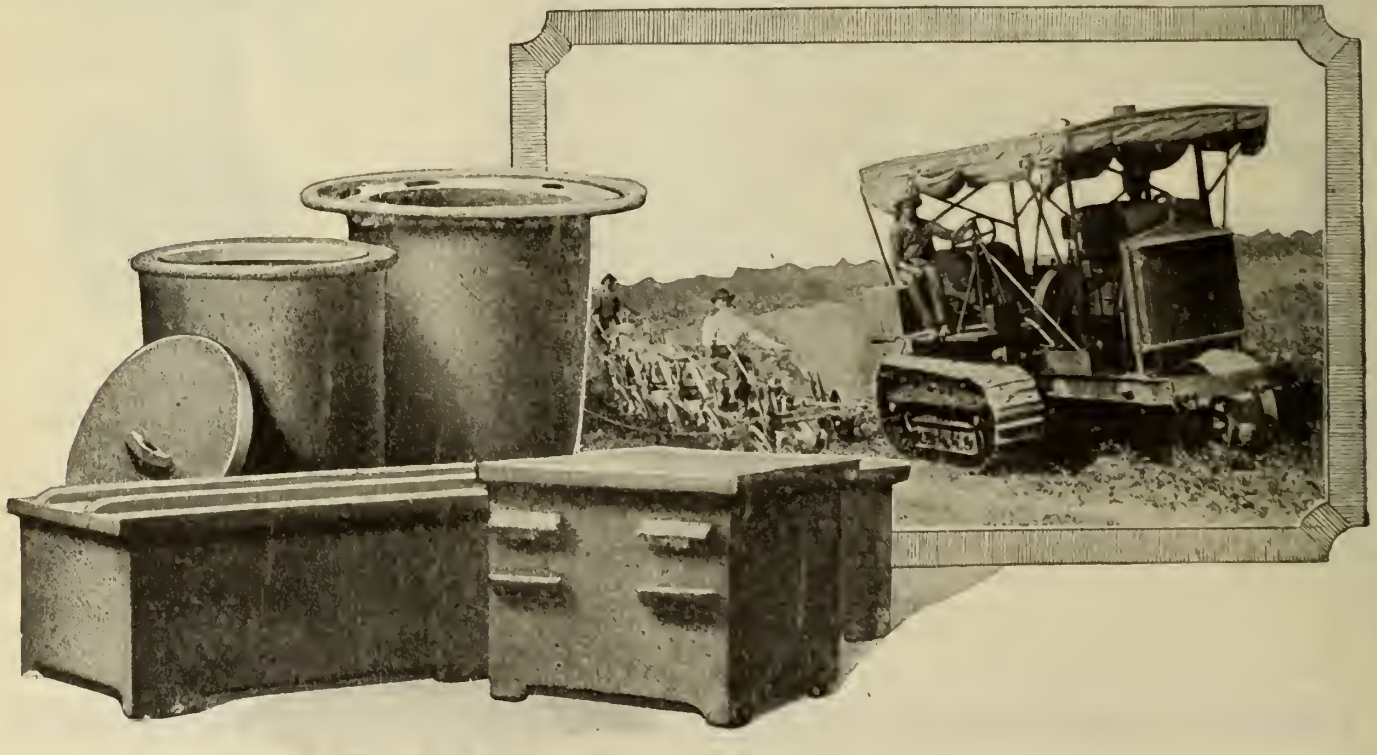
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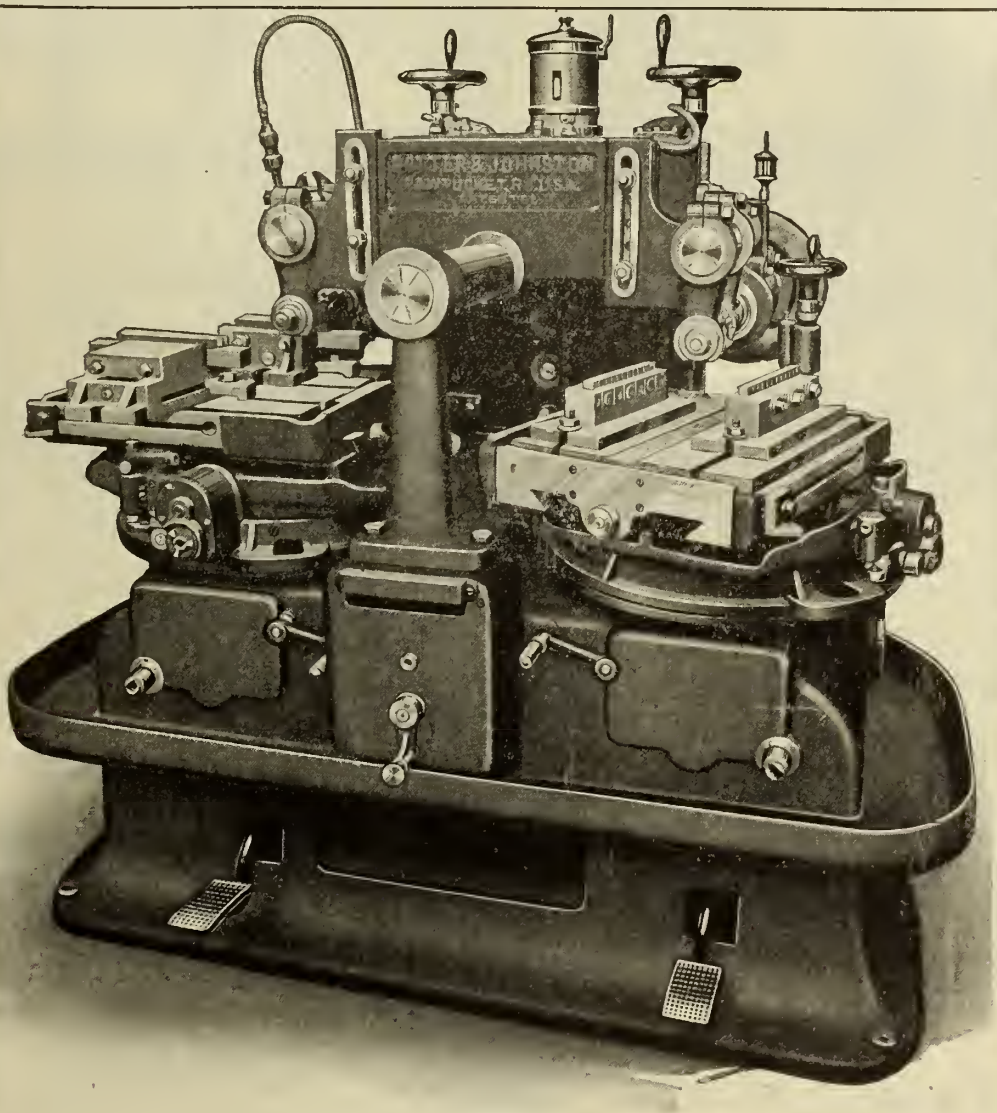
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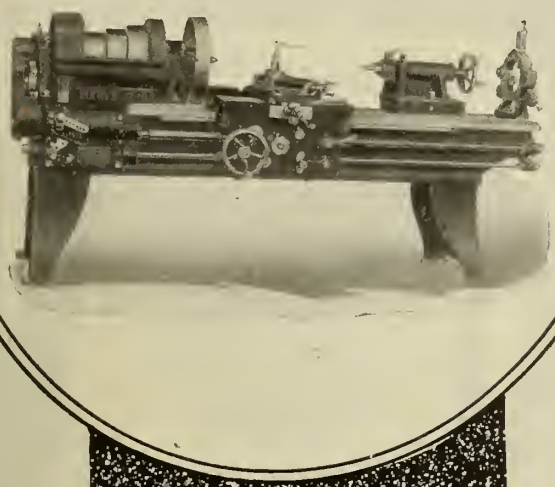
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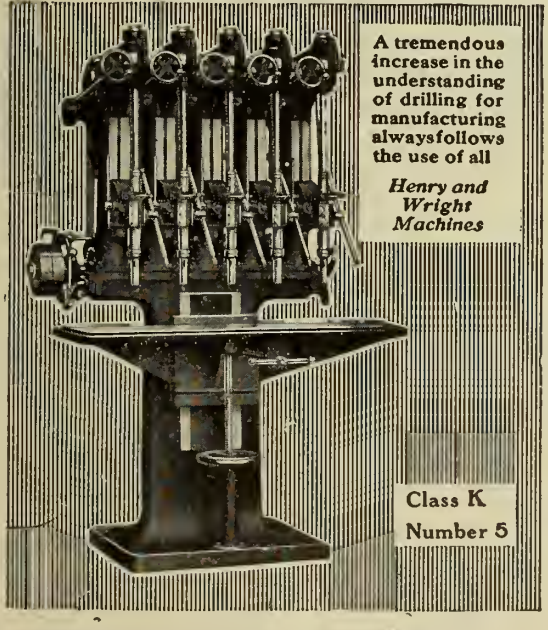
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A File Has Limits

A file can't do good work after it has lost its original sharpness.

Remember this, and throw a file away as soon as it shows signs of getting dull.

It will repay you in the end.

The following brands do not get dull until they have given you full value for your money. Specify one of them when ordering:

Kearney & Foot
Great Western
American
Arcade
Globe

FILES

Made in Canada by

Nicholson File Company

Port Hope - Ontario

DUNBAR SPRINGS

ACCURACY ASSURED

You can always depend upon Dunbar Springs being accurate. Before proceeding with any order the first few springs are carefully tested and checked up for this very purpose.

Seventy-two years' experience making flat and spiral springs of every description enables us to furnish you with springs of the highest quality, that can be depended upon under all conditions.

Send blue prints for estimates.

The Dunbar Brothers Co.
BRISTOL, CONN.



REAL FIRE BRICK SERVICE

When you buy Elk Fire Brick we sell you a brand with the qualifications equal to the duty for which it is intended. We do not recommend the best quality brick for a certain job if a lower-priced brand will stand up just as well. Each brand of

ELK FIRE BRICK

has some particular qualification which fits it to give better results in certain places than other brands we produce.

OUR BRANDS:

"Elkco"
"Elkco" Special
"Elk Steel"
"St. Marys"
"Keystone"
"M.D. Elk"
"Rotex"
"Elk Ladle"
"Elk Dust"
"Keystone Dust"
"Rotex Dust"

Try us on your next fire brick needs. You'll find both our quality and service right.
Large stocks of various shapes carried in warehouse in Hamilton.

ELK FIRE BRICK CO. OF CANADA
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Sun Life Building, HAMILTON, ONTARIO

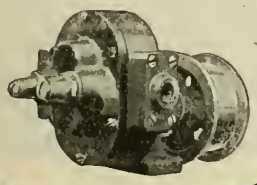
TRAHERN PUMPS

TRAHERN

The Pump that Outlives the Machine

TRAHERN Circulating Pumps are especially constructed to operate at low speeds (300 to 500 R.P.M.), thus insuring minimum wear and exceptionally long life.

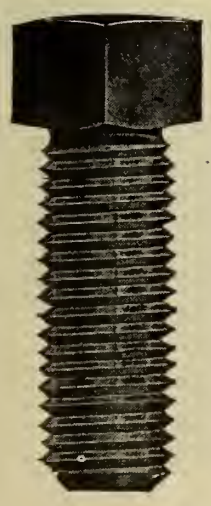
Our bulletin No. 44 will explain in detail.



If the pump is inefficient the machine tool will be handicapped and unable to produce its maximum. See that the tools you buy are equipped with Trahern Coolant Pumps—thus you will be assured of efficient lubrication for the entire life of the machines.

TRAHERN PUMP DIV.
Geo. D. Roper Corp.
ROCKFORD, ILLINOIS, U.S.A.

ACCURACY



Prompt shipments of all Standard Sizes in
Cap Screws, V or U.S.S.
Cap Screws, S.A.E.
Set Screws, V or U.S.S.
S.F. Hexagon Nuts, V or U.S.S.
S.A.E. Hexagon Nuts, Plain.
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Turned Paper Pins.

Send us your rush orders.

THE
GALT MACHINE SCREW CO., LIMITED
GALT, ONTARIO

Eastern Representatives: The Canadian B. K. Morton Company Limited, 49 Common St., Montreal, Que.



MESTA MACHINE COMPANY
General Office and Works: Pittsburgh, Pa., U.S.A.

GAS AND STEAM ENGINES

for
Blast Furnaces, Rolling Mills
Power Plants
Gear Drives, Rope Drives, Condensers
Air Compressors Vacuum Pumps

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Blooming Mills	Tin Plate Mills
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Pickling Machines Metal Mixers
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Ship Shafts General Forgings

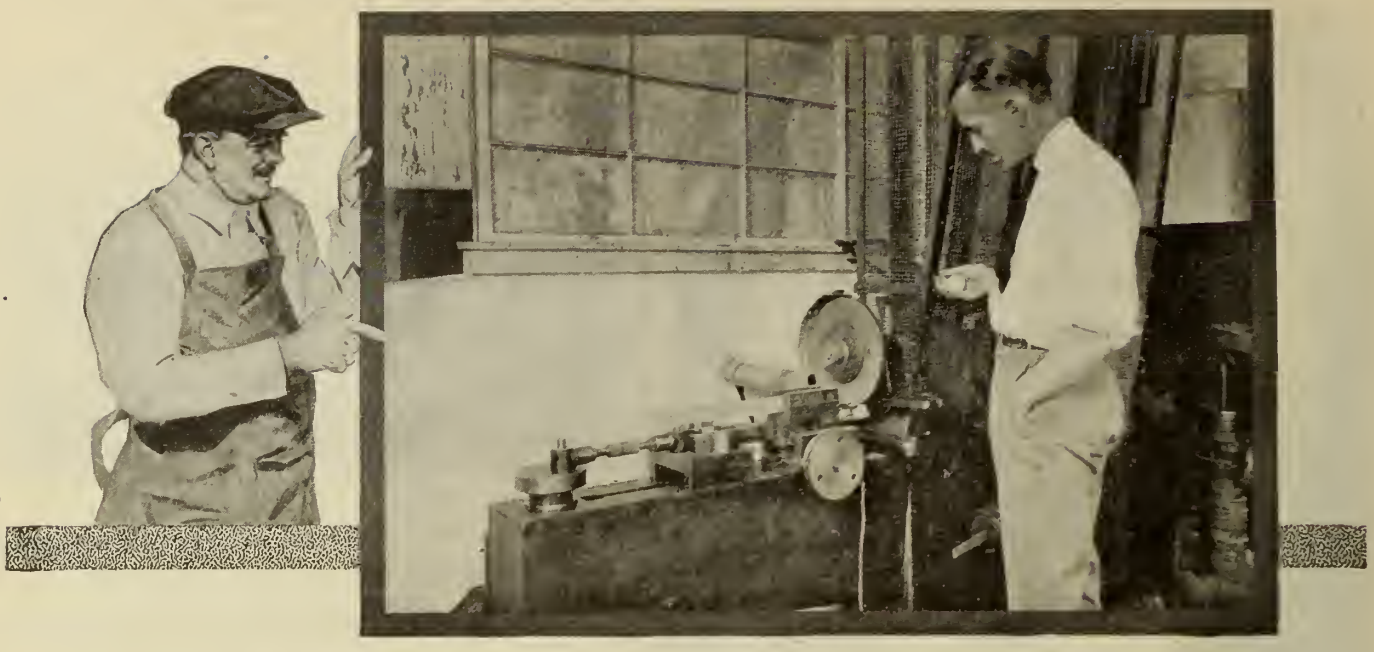
CASTINGS

Carbon Steel—Alloy Steel—Bronze
Air Furnace Iron Castings
Carbon and Alloy Steel Forging Ingots

Write for Bulletins

MESTA MACHINE CO.
Pittsburgh, Pa. U.S.A.

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Leadership doesn't come like a meteor

F. G. pulled out his watch and turned on the current. The queer looking machine in the corner of the laboratory tuned up. "Our leadership," said F. G., "has to be insured somehow. We do it with machines. Machines tell the cold-blooded truth."

And when he'd finished putting that wizard-like machine through its paces, I knew what F. G. meant by "leadership insurance."

Here's the story—

When Speed-grits abrasive discs were entered in the market sweep-stakes, they hurdled their way straight into first place. Disc users—the regular fellows, superintendents, foremen, workmen—all spotted them as first under the wire.

But up in the Manning Abrasive Company's plant at Troy, N. Y. (the home of Speed-grits) they are "show me" men.

These flesh-and-blood question marks wanted to put a stop-watch on the speed of Speed-grits—to find out with precision exactly what production Speed-grits discs could reel off when pushed to the limit. But how? No machine could be found which would tell *exactly* how great a difference existed between one disc and another. So they set to work and made one.

The result? Look at the machine shown above. No human being could possibly make the test that it makes. No human being could possibly hold material against a grinding disc at a scientifically exact constant given pressure.

But this machine does that and more. On it Speed-grits discs are tested out against discs or every known brand—grinding tests on steel, iron, brass, alloys, etc. Before they are turned out into the manufacturing world to spread the increased-production idea, Speed-grits must qualify 100% for their part in the big industrial race. Also—

Day in and day out, these same "show me" men are busy making up new types of Speed-grits discs which are tested on the new testing machine, tried out against the present Speed-grits leaders.

"Incidentally," I said to F. G., "this vigilance 'bug' of yours is sure cramming in good service for Speed-grits users. Why not tell them about it?"

"Go ahead," said F. G.

So I have.

Today, wherever there is fine finishing being done look for Manning Speed-Grits—today manufacturers are finding the difference between ordinary abrasives and Manning Speed-grits—today—

Manning Speed-grits

Look for this trade-mark on the back of every sheet, belt or disc

"Good Workmen Know the Difference"

Send for "The Difference Book"—Address

RITCHEY SUPPLY COMPANY

154 Pearl Street (*CANADIAN DISTRIBUTORS*) Toronto, Canada

Or send to Manning Abrasive Co., Troy, N.Y. U.S.A.

Speed-grits

comes in the following varieties:

METALITE CLOTH
HANDY ROLLS
GRINDING DISCS
DURITE CLOTH
DURITE PAPER
DURITE COMBINATION
DURUNDUM PAPER
DURUNDUM CLOTH
GARNET PAPER
GARNET CLOTH
GARNET COMBINATION
FLINT PAPER
EMERY CLOTH
EMERY PAPER

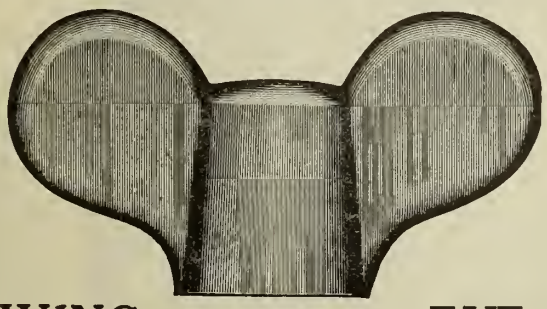
Manning Speed-grits

Reg U.S. Pat. Off.

Don't say sandpaper—say Speed-grits

CANADA
FOUNDRIES & FORGINGS
LIMITED

DROP FORGED STEEL



WING NUTS

EYE NUTS

All Sizes

Canadian Billings & Spencer Plant
Welland

BABBITT METALS



Imperial
Genuine

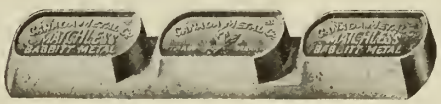
Made for extra heavy duty, such as Main Bearings on Turbine Generators, Calender Rolls in Pulp Mills, is specially adapted for Marine Engines.



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THE
BABBITT METAL
WITHOUT A FAULT

For Donkey Engines, Saw Carriages, Small Motors, Transmission Line Shafting and all steady heavy pressure duty.



Matchless

Suitable For Slow-Moving Bearings

THE CANADA METAL CO., LIMITED
TORONTO HAMILTON MONTREAL
WINNIPEG VANCOUVER

LANDIS

Why you get accurate work



Because of the principle involved on all LANDIS Grinders. The grinding wheel travels, as the work revolves, this ensuring accurate work with no variation in the degree of accuracy.

This principle has proven to be the correct one as evidenced by reports from grinding machines in service for 20 years and still producing accurate work.

Catalog containing detailed information upon request.

Landis Tool Company, Waynesboro, Pa.

Canadian Agents: A. R. Williams Machinery Co., Toronto, Winnipeg, Vancouver
Williams & Wilson, Montreal

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MILWAUKEE MILLING MACHINES



Giving Satisfactory Results Everywhere

Here are some Milwaukee Milling Machines in a section of the tool-room in the plant of the Webster & Perks Tool Co., Springfield, Ohio, manufacturers of Machine Tools, special machines, jigs and fixtures.

The single overarm machine at the extreme left was purchased many years ago and gave such complete satisfaction that, as other machines were required, more Milwaukee Milling Machines were purchased.

This is one of the many instances of satisfied users. The accuracy, rigidity and ease of operation of these machines make them ideal for all classes of milling—light or heavy.

All Milwaukee Horizontal Milling Machines now possess the double overarm which is decidedly rigid, assures positive alignment of the arbor and accurate milling.

Write to-day for our catalogue.

KEARNEY & TRECKER CO. MILWAUKEE, WIS. U.S.A.

Canadian Representatives: Williams & Wilson, Ltd., Montreal; F. F. Barber Machy. Co., Toronto; A. R. Williams Machy. Co., Vancouver and Winnipeg

"THE DRAMA OF OUR GREAT FORESTS"

By ARTHUR HEMING

THE primitive spirit of the Northland—the land of hunters, trappers, voyageurs, factors, and the animals of the forests—lured Arthur Heming farther, ever farther, into the depths of its enthralling mysteries. Twenty-three times Heming—who is an author of note as well as Canada's greatest painter of out-door life—pitched his tent and traveled the wilds, from New Brunswick to the Yukon. He tells in this remarkable series of articles, which he has written for MacLean's Magazine, the story of his adventures, how he traveled with the noted Indian hunter, Oo-koo-hoo, and no detail of this colorful experience has escaped his pen or brush.

Twenty Paintings Reproduced---Valuable Historical Treasures

Twenty paintings, which will be valuable historical treasures of Canada, accompany his articles, and several will be reproduced in three or four colors, on the covers of the November 15th and succeeding issues.

Keep the Entire Series for Historical Reference

Parents!

Here is an all-absorbing story to read aloud to the youngsters—a story that teems with history, romance and adventure—a story that will delight the youth of Canada, and you grown-ups, too. It took the author thirty-three years to gather the information this series contains. It depicts life in the wilds as few have seen it—from the Atlantic to the Pacific, ever-changing, ever-interesting. Here is thrilling romance of the fur-trade days. Take your family on a pilgrimage to the Canadian wilds—study Canada and the forest-dwellers from a new angle. "The Drama of Our Great Forests" is historical and educational. The entire series should be in every Canadian home. Start with November 15th issue of MacLean's.

Teachers!

Make good use of "The Drama of Our Great Forests" for the Friday afternoon reading hours. Pupils will be deeply interested in this story of the Canadian wilds—of its forests, its rivers and lakes, its hunters and traders, its fur-runners and mounted police, its missionaries, Indians and prospectors, its animals, its trees and flowers. Here is geography and history in a new guise—never to be forgotten. An abundance of Indian-lore for the red-blooded boys; clean-cut romance for all. Read the series with your pupils—have them follow the fascinating journeys of Arthur Heming—have them study the reproductions of Indian manuscripts—the descriptions of Indian customs, and the colored covers of MacLean's painted by this great artist. Tell your pupils about the series starting in November 15th MacLean's.

Boy Scouts, Girl Guides

Let Arthur Heming tell you about life in the Canadian wilds. Let him tell you how to read Indian signs as he has seen them during his many adventurous journeys. He has written a great story—"The Drama of Our Great Forests"—for MacLean's Magazine. It starts in the November 15th issue. Mr. Heming is a great artist, writer and traveler. He shows how Indians blaze trails in the forests—how they use sticks and pieces of clothing for signs—how they draw signs on trees and teach sewing. And he tells how Indians get their dyes, how they trail animals, trap them and sell them to Hudson's Bay Posts. See the illustrations for the story in each issue of MacLean's—study them carefully—you can discuss them at meetings. This story is full of just the sort of information you want—it will make you a better Scout or Guide—and you will be glad you are a Canadian. Start with the first issue—November 15th—and get the entire scries.

Who is Arthur Heming?—Artist, Writer, Traveler, Adventurer

HE has "bunked with cussing cow-punchers—loped along lonely patrols with the Mounted Police—followed moose and caribou for a hundred miles for nothing more than a pencil sketch—and has ensconced himself in a London studio, an artist pre-eminent among artists," writes Arthur Stringer. He paints things in the North as they are. To get the material for his life work he has traveled from New Brunswick to the Yukon, by canoe, pack-train, snowshoes, bateau, dog-train, buck-board, timber raft, prairie schooner, lumber wagon and "alligator."

But Arthur Heming has caught it—and held it—and passed it on to the readers of MacLean's. Do not miss a single issue. Keep the entire series for historical reference. Start with November 15th issue.

SECURE YOUR COPY EARLY---THE SUPPLY IS LIMITED.

OVER 80,000 CANADIAN FAMILIES BUY

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"CANADA'S NATIONAL MAGAZINE"

NOVEMBER 15th ISSUE *On All News-stands* *20c*

Or Send $3.00 for a Year's Subscription to MACLEAN'S MAGAZINE, 143-153 University Avenue, Toronto, Canada



The City of
ST. JOHNS
QUEBEC

Locate in this Real Transportation Centre

St. Johns is a nerve centre of the network of railways connecting Central and Western Canada with the Maritime Provinces and with the Eastern States. Seven railways, including the C.P.R. and G.T.R., run through the city and are interconnected in the St. Johns yards by a terminal switching company. The manufacturer locating in St. Johns enjoys the advantages of competitive freight rates and dispatch in the assembling of raw materials and distribution of the finished product. The city in fact commands lower freight rates and a cheaper coal supply than any other centrally located manufacturing city on the North American continent.

St. Johns is directly connected by rail with the Montreal docks, 27 miles distant, affording first-class facilities for foreign trade. The city is an ideal location for the American manufacturer opening a branch plant in Canada; having direct connections by water with New York, the St. Lawrence and Great Lakes and the Eastern Seaboard of the United States.

Unlimited electric power is developed at Chambly, eleven miles north-east of the city, and distributed at prices that will compete with any city or town in the Dominion.

Cheap living conditions and low rents and taxes have resulted in cheap labor and an abundant supply of both skilled and unskilled workers is always available. Labor troubles are quite unknown.

In addition to the natural advantages of St. Johns as an industrial site the city also offers extraordinary inducements, such as: Tax exemptions; street extensions; bonus of five per cent. on your payroll for five years, making it an unusual industrial opportunity.

Without a knowledge of your business or the conditions affecting it, we do not claim that St. Johns is rationally your location; but we know that St. Johns possesses extraordinary advantages, that in all probability it is the best site for your plant from every point of view, that you will be running the risk of serious mistake if you do not include this city in your investigations.

Seven railroads, including Canada's great transcontinental lines.
Finest ocean shipping facilities.
Canal connections with New York, the Eastern States, and the Great Lakes.
Cheapest labor market in Canada.
Plentiful supply of skilled and unskilled labor.
Cheap and abundant electric power.
Cheap coal and lower freight rates.
Desirable factory sites with all public conveniences immediately available.
Extraordinary inducements to new industries.

For more specific information write

The Secretary, City Council
ST. JOHNS, QUE., CAN.

MINISTRY OF MUNITIONS
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The Disposal Board

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Lying in the United Kingdom and

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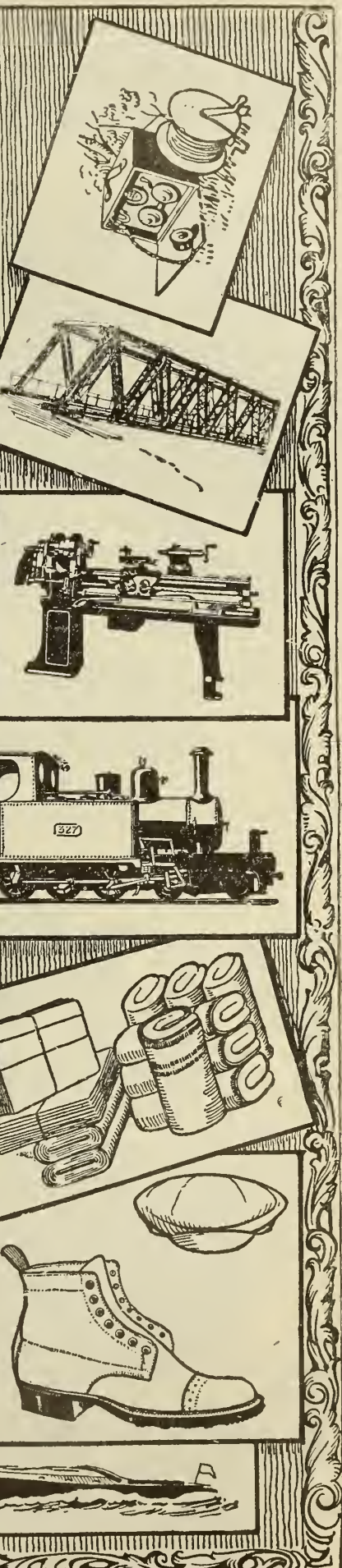
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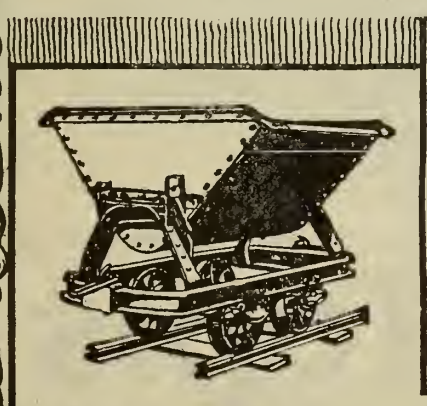
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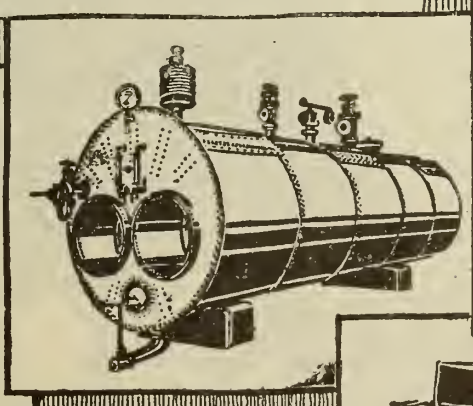
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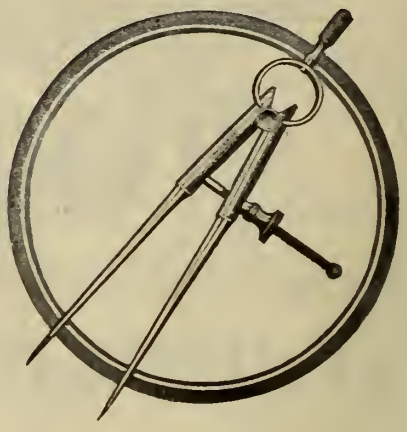




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40 Years of Progress with Fine Tools

"--when typewriters were curiosities."



Forty years ago, when the typewriter was still a "new-fangled contraption", machinists were beginning to learn what so many thousands know today—that Starrett Tools are made to insure complete satisfaction to the men who use them.

"Tools just a little better than were ever made before" was the Starrett idea in 1880. It is the same in 1920. That explains why Starrett Tools have had so big a share in the industrial development of the country.

If you're interested in fine tools write for a copy of Catalog No. 22 "3."

THE L. S. STARRETT COMPANY

The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.

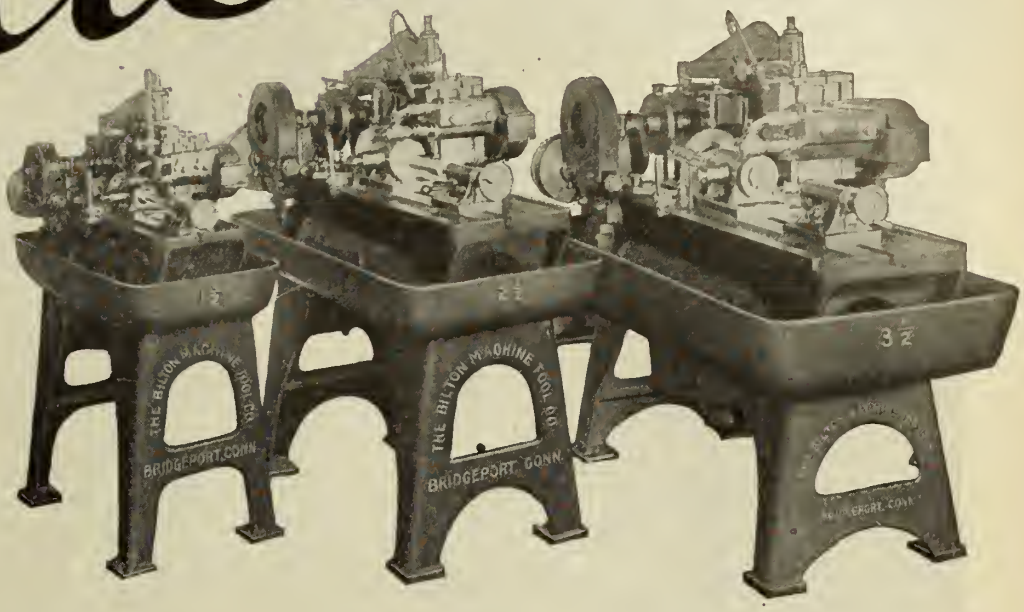


Use Starrett Tools

STARRETT TOOLS
STARRETT HACK SAWS CUT QUICKER LAST LONGER

42-122

Bilton GEAR MILLERS



Fully Automatic

Their adaptability is almost unlimited on small work—such as cutting spur, bevel, miter, angle gears, saws, ratchets, sprockets, cutters, knurls, taps, cylinders, form cutting, manufacturing, milling, etc.

A big time saver, as indexing takes place during return stroke of cutter — which is removing metal 90% of the time.

Write us for Catalog 30-6

Over 500 leading manufacturers now use the Bilton for high production on accurate work

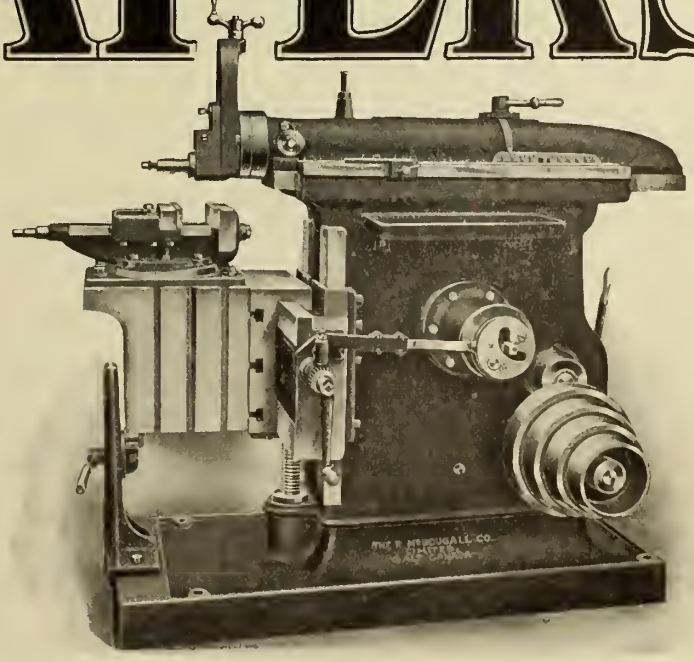
Bilton Machine Tool Co. Housatonic Avenue **Bridgeport, Conn., U.S.A.**

Foreign Agents: Alfred Herbert, Ltd. Chas. Churchill & Co., Ltd.

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Modern machines characterized by simple, clean-cut design and inflexible rigidity combine the best features of machines hitherto on the market, but with all unnecessary complications excluded.

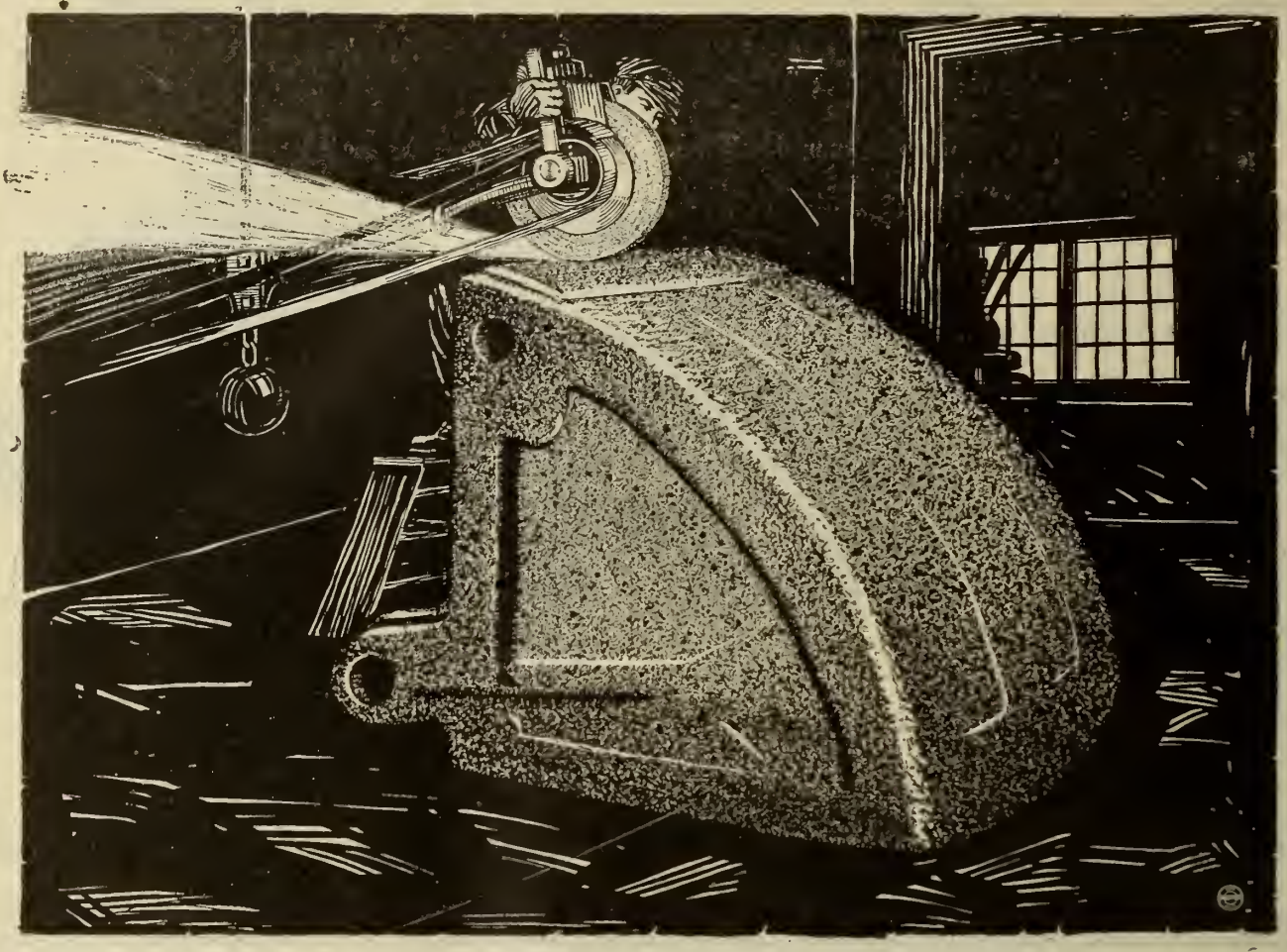
We shall be glad to send you complete specifications and descriptions.



The R. McDougall Co., Ltd.
GALT, ONTARIO

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED
Sole Agents

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Grinding Wheel Economy in the Foundry

A thorough knowledge of the physical properties of the metal to be ground is the first essential to the economical use of the grinding wheel in the foundry. The selection of the proper abrasive is entirely dependent upon this knowledge.

For materials of high tensile strength—annealed steels, malleable or wrought iron—the best results will be obtained by using Alundum wheels. On gray cast iron, chilled iron, malleable iron, brasses, bronzes, aluminum or copper, Crystolon wheels will be found the most efficient.

The size of the wheel, the amount of material to be removed and the nature of the material readily determine the size of the grain. Finish is seldom a consideration; therefore it is always best to use as coarse a wheel as practicable.

The speed of the grinding wheel is of the utmost importance, and must be held within the correct speed range of from 5,000 to 6,000 surface feet per minute, if proper cutting action and economy in wheel consumption are to be obtained.

The life of a grinding machine largely depends upon the care it is given—all bearings must be kept adjusted and in good condition—the spindle must be rigid and the foundation solid. A grinding wheel that vibrates or jumps is soon pounded to pieces by the shocks and stresses from the action of the castings on the face of the wheel.

The personal factor should be given careful consideration. No two men will get the same life or production out of a wheel even though the work and conditions are identical—some work the corners hard, others are abusive in applying the castings, or will remove too much abrasive in dressing. All these factors have their effect and often the manufacturer is unjustly blamed for apparent variations in wheel life when the true cause can be attributed to the personal factor.

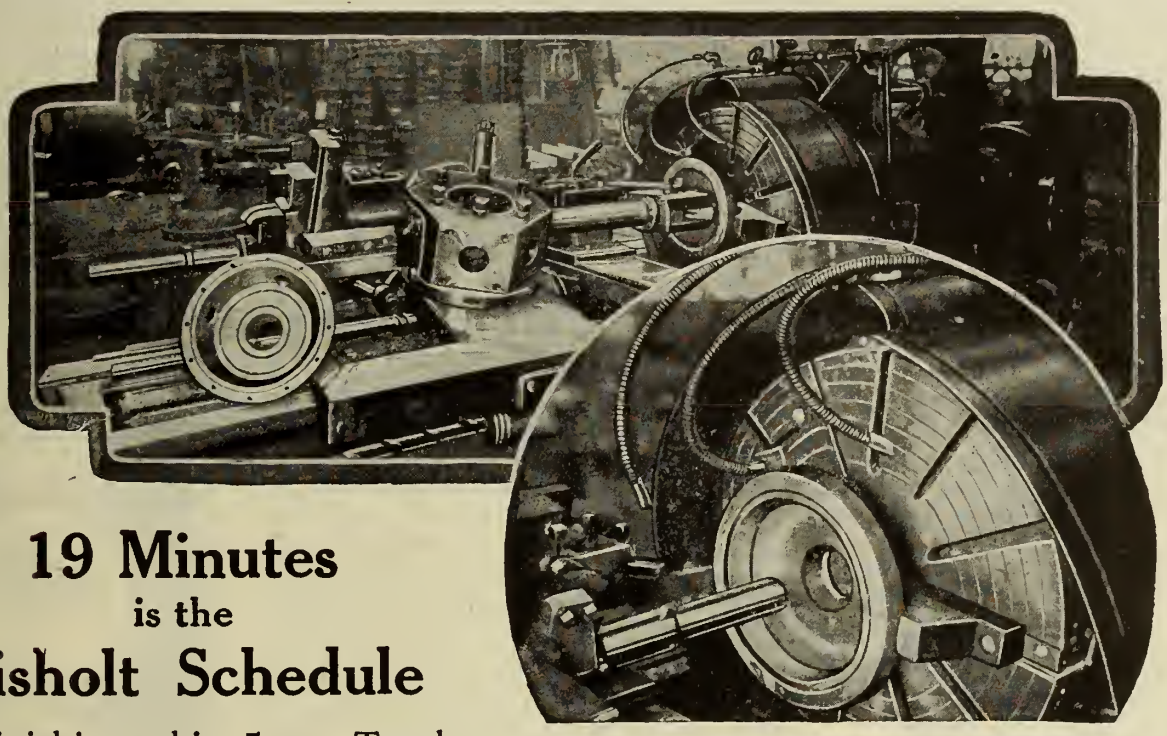
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HAMILTON, ONTARIO

Electric Furnace Plants: Niagara Falls, N.Y.; Chippawa, Ont., Canada.

Canadian Agents: The Canadian Fairbanks-Morse Co., Ltd., Montreal, Toronto, Ottawa, St. John, N.B., Winnipeg, Calgary, Saskatoon, Vancouver, Victoria.

R-43 *F. H. Andrews & Son, Quebec, Que.* *Simonds Saw Co., Vancouver, B.C.*

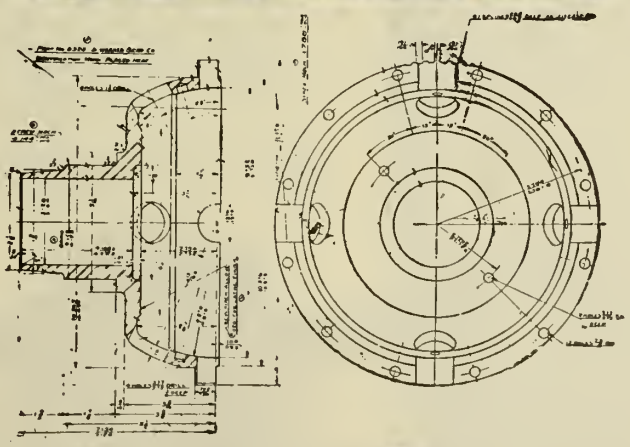
GISHOLT



19 Minutes
is the
Gisholt Schedule

for finishing this 5-ton Truck Differential part made from Drop Forged Steel, 20 to 30 Carbon as shown by the drawing. Gisholt production is always dependable.

A new book showing the Gisholt Turret Lathes and the work they produce is ready for distribution. Send for your copy.



GISHOLT MACHINE CO., 1207 East Washington Ave., MADISON, WIS., U. S. A.

Builders of Standard and Automatic Turret Lathes; Vertical and Horizontal Boring Mills, Tool Grinders, Small Tools, Special Machinery, etc.

Eastern Sales Office: 30 Church St., New York *Works:* Madison, Wis., Warren, Pa.

Canadian Agents: The Canadian Fairbanks-Morse Co., Ltd., St. John, Quebec, Montreal Ottawa, Toronto, Hamilton, Windsor, Winnipeg, Saskatoon, Calgary, Vancouver, Victoria

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FAIRBANKS-MORSE

FAIRBANKS-MORSE QUALITY
F M
100%

Mastering the Waters of the World

Mastering of the waters of the world has been and is an important factor in the advancement of civilization. The Canadian Fairbanks-Morse Co. Limited, claims its share in this advancement.

No matter where you live, or what your business, you are constantly dependent on pumps for the water you drink, for the protection of your home from fire, or the production of the things you use, wear, and eat. And quite likely it is a Fairbanks-Morse pump, for Fairbanks-Morse pumps have long been recognized as standards—dependable pumps, constantly giving maximum service under the most exacting conditions.

The Canadian Fairbanks-Morse engineers know the pumping problems of Canada and, with all the resources and reputation of this national institution behind them, have developed pumps that meet every requirement and meet it with a product that is worthy of being branded "Fairbanks-Morse 100% quality."

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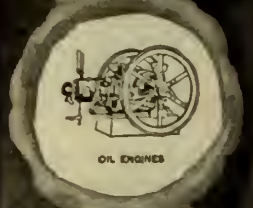
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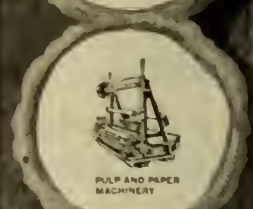
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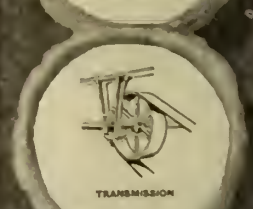


























CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXIV. No. 22 November 25, 1920

Here Is One Method of Making Back Gear Parts

Can You Suggest a Better Plan of Producing These Parts? If so, We Want to Hear About It—The Author Merely States His Views Upon the Problem.

By G. BARRETT

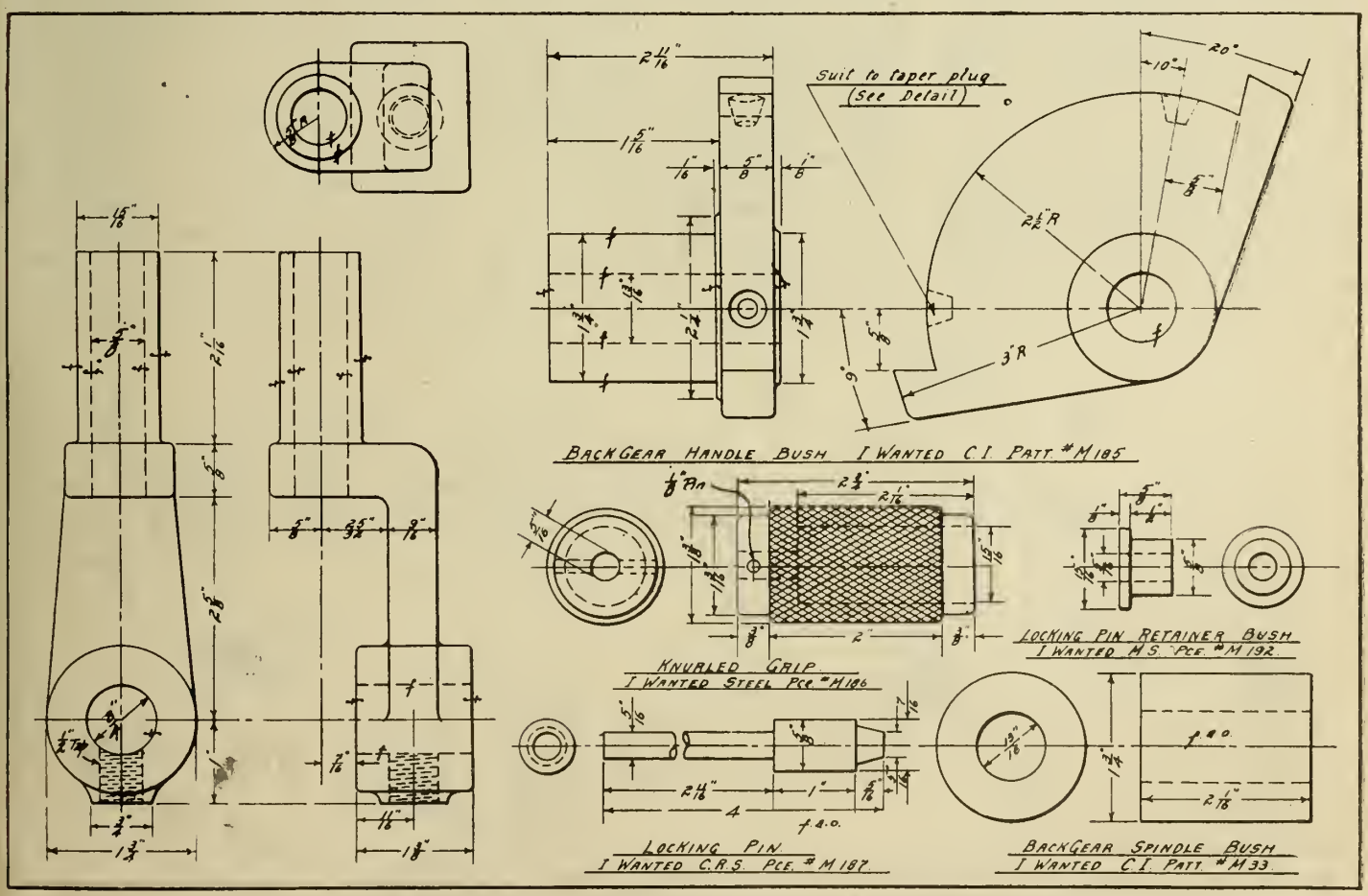
RELATIVE to the manufacture of back gear parts these pieces could be made in various ways, using screw machines, Jones and Lamson bar turrets, semi-automatics, disc grinders, etc. However, we will take a Warner and Swasey for our lathe work, as it is particularly adapted to the work, and by the use of specialized labor would give very good results at the least cost of production.

In machining the lever, the first operation would be the facing of the two sides of the large boss. These pieces would be clamped on the indexing fixture, Fig. 1, the boss being supported by the V-block A, shown in the sectional sketch. This support is to take the strain of the cut of the straddle milling cutters B, the clamps C and D holding the lever firmly in position.

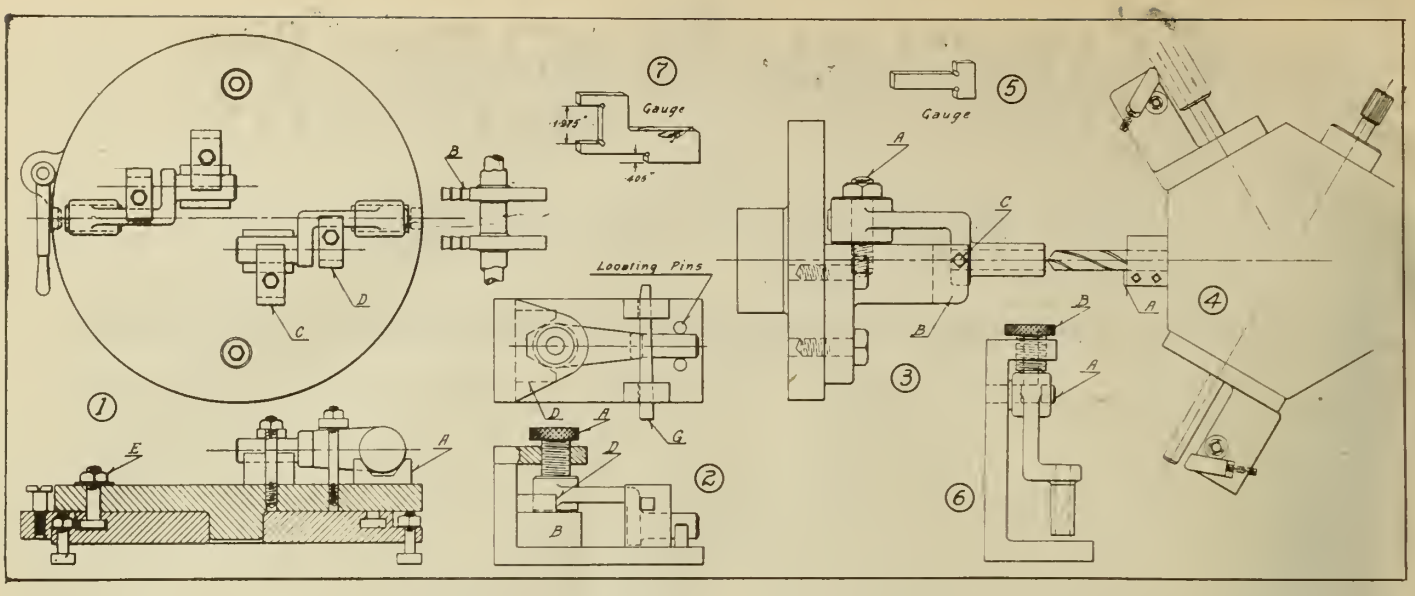
The bolts E work in T-slots and are used to clamp the upper revolving part of the fixture after indexing, thus keeping the fixture rigid while milling the boss. The advantage of this method is that one piece can be placed in position while work is proceeding on the other. The approximate output from this machine would be 16 per hour.

Second Operation

The second operation would consist of drilling and reaming the 3-4 inch hole in the boss which is accomplished in the jig, Fig. 2. The lever is held flat on the boss by the knurled bush A, which is just sufficiently tightened to bring the lower face square on the block B; then by means of the taper drift C, the lever is held up to the V-block D. The outer portion of the lever



HERE WE SEE THE VARIOUS DETAILS. STUDY THEM CAREFULLY.



THIS SHOWS ARRANGEMENT NO. 1, AND INCLUDES FIGS. 1 TO 6.

is centred by the two locating pins shown. The average production from this operation should be about 22 per hour.

The third operation would consist of boring and turning for the knurled grip. This would be performed on a turret lathe and held in position by the pin A, Fig. 3. The fixture used is a special casting and is held to the face plate by suitable cap screws. After being perfectly aligned the casting could be doweled, so that the same could be removed and replaced at a future date for quick and accurate setting. The fixture proper is slotted at B, leaving about 3-16 inch clearance for the offset in lever. This clearance is to provide for adjustment of irregular castings.

This detail is taken care of by two set screws, one on either side of the fixture. The first operation on the shaft portion is spotting the end and then drilling, using a straight shank drill, this being done to allow of close setting when using the facing tool A in Fig. 4. The gauge for this operation is shown in Fig. 5. We next rough turn the outside, leaving about 1-16 inch for finish. This roughing is done by means of a box tool, using Stellite tool bits. The next face of the turret would carry the reamer for finishing the hole to size. The next detail is the finish turning of the outside. The time required for these operations would provide for an output of about 100 per day of nine hours.

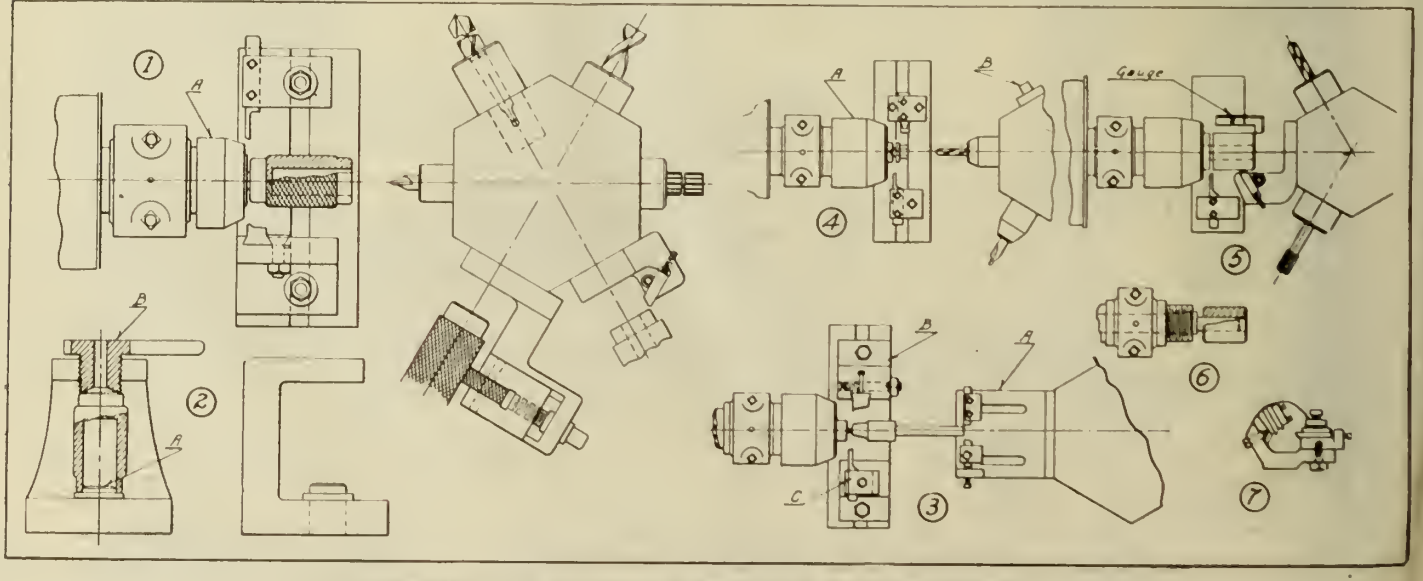
The final operation on this lever would be that of drilling the 1-2 inch tap hole in the boss. The jig for this is shown in Fig. 6. The drill bush acts as a clamp for holding the work while drilling. Two of these jigs are used, one for drilling and one for tapping. Production from these jigs would be about 300 per day.

Knurled Sleeve

The knurled sleeve is made from cold rolled stock of the required diameter, the bars being held in the collet chuck A, Fig. 1 in arrangement 2. This piece has eight operations, comprising centering, drilling, squaring bottom of hole, reaming, turning clearance for knurl, knurling the body and drilling the end and pin holes. The lathe setup is shown in Fig. 1. The 5-16 inch hole is drilled in the jig Fig. 2, the machined end resting on the plug A and the upper end held by the drill bush B. The lathe would produce about 50 per day and the drilling would account for approximately 250 per day.

Work on the locking pin is shown in Fig. 3. This pin would require three operations on the 5-16-inch shank. Box tools are used for the turning of the stem, three of them being used for taking off different amounts of stock. The tapered end of the pin is formed by a special tool fitted to the rear of the cross slide. The piece is then parted off by the front tool C. The production would be about 200 per day.

The small retainer bush is made from 15-16-inch cold rolled steel, using the collet chuck on the lathe spindle A in



ARRANGEMENT NO. 2, SHOWING WORK ON THE KNURLED SLEEVE.

Fig. 4. The stock is fed through the spindle to the stop B, and then drilled to the required depth. The tool on the rear of the cross slide is then used to turn the small diameter, after which the piece is cut off by the parting tool in the front holder. About 400 per day should be made on this operation.

The spindle bushes are made of cast iron, cast in lengths of about 2 feet, roughed out to within 1-16-inch of the finished size, and then placed in the turret lathe where they are drilled, reamed and finish turned and cut to the required length, as shown at Fig. 5. The possibility of a burr on the inner end would require the pieces to be placed on a separate arbor and the end faced off, as shown at Fig. 6. The first operation would give a production of about 150 per day and the facing would produce about 90 per hour.

Machining the Sector

To machine the sector the piece would be gripped by the hub in the two jaw chuck Fig. 1, arrangement No. 3. The sector is drilled, reamed and faced, using gauge B. The facing tool C is made from bar stock with inserted blades and pilot. About 200 per day should be got from this operation. The next operation is drilling and reaming for stop pins. This is done in a box jig Fig. 2, the sector being centered from the hole already bored and held against locating pin A by the pointed set screw B. This pin is used to bring the lugs on the sector to the proper position from the centre of the stop pin holes.

After tightening the set screw the sector is held by the taper drift C. The drill bushes are made a slip fit so as to be renewed while reaming holes. For this operation we use a two spindle drill, one spindle carrying a drill and the other the taper reamer. Output about 300 per day. The final operation on the sector is shown in Fig. 3. This is the turning of the hub. This is done on a lathe fitted with a hardened steel arbor A, inserted and ground to fit the hole in the hub. The special face plate B is made to accommodate two set screws C and D, which are located in the desired position to screw into the stop pin holes. These set screws need very little tightening in order to hold the work. The facing tool E has a hardened steel pin inserted and set to the required distance from the cutters. The output from this operation would be about 100 per day.

In the making of all these parts it is essential that every operation be accurately performed to avoid trouble in succeeding operations.

In my estimation the cost of these jigs and fixtures would be around $400, and this figure would mean a considerable saving in the first 1,000 plates.

A safety device for punch presses, developed at the works of the Ford Motor Company, makes it impossible for the workman to get his hands in the way of the plunger. To operate a press thus equipped the workman must press two buttons about a foot apart, so that it is necessary for him to use both hands. A two-man press so equipped will not trip until four buttons are pressed at one time; a three-man press will not trip until six buttons are pressed simultaneously. According to a director of the company, the device has not only practically eliminated punch press accidents, but has increased production on an average of 10 per cent., owing to eliminating the fatigue resulting from the operation of punch presses by a foot trip. All punch press operators are required to use tongs for inserting metal and taking it out of the presses.

INTERESTING CATALOGUE

The Canadian Blower and Forge Co., Ltd., Kitchener, Ont., have issued a new catalogue, No. 19C, dealing with their varied line. This includes forges, blowers, exhausters, fans, drills, punches, shears, binding machines, tire setters.

Combination wood working machines, fan system apparatus for heating, ventilating, drying and mechanical draft, air washers, humidifiers, dehumidifiers, pumps, etc., etc., are also shown. This book contains 186 pages of real, live information to those interested in such lines.

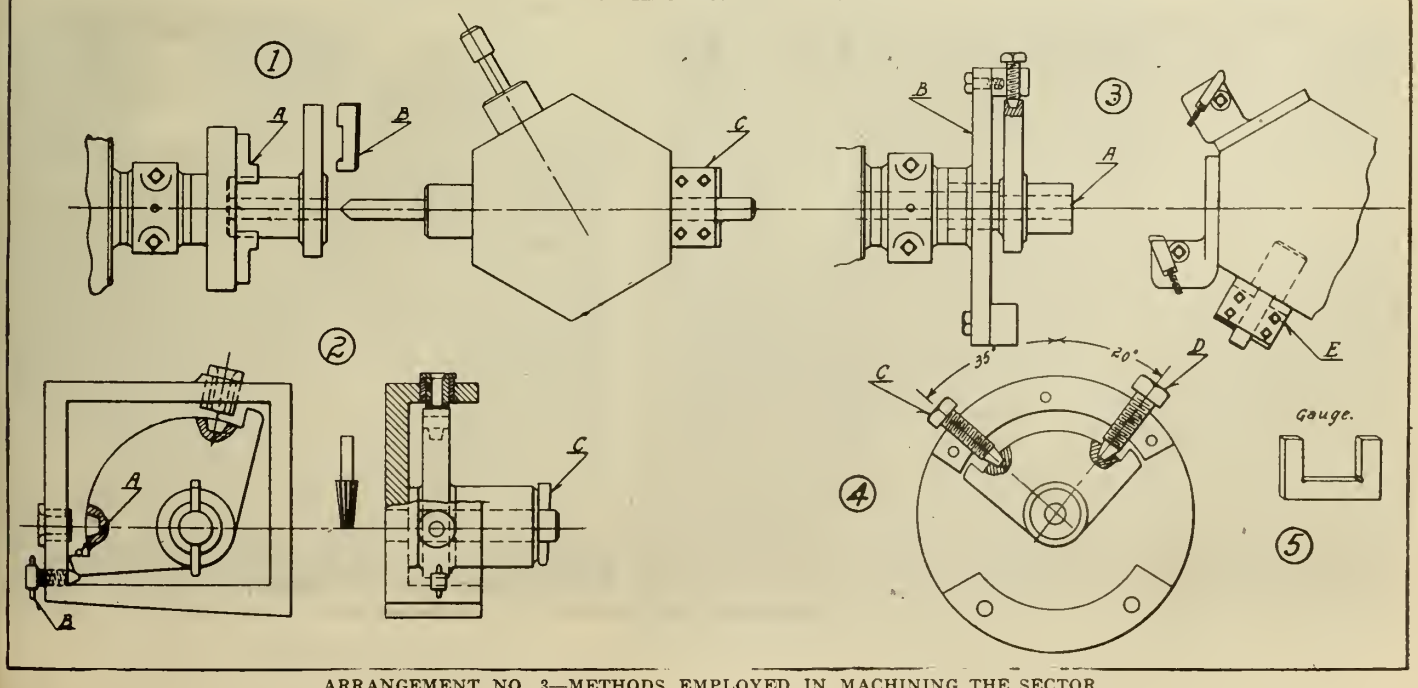
NEW CATALOGUE

The Machinery Co. of America, who are distributors for Baldwin, Tuthill & Bolton, Covel Mfg. Co., and Hanchett Saw Works, have issued a very nice catalogue dealing with the lines mentioned above.

These include saws, automatic band sharpeners, saw sharpeners and gummers, roll stretchers, saw stretchers, lap grinders, brazing clamps, saw brazing forges and shearing and cross cutting machines.

Other lines shown are filing clamps, stands for band saws, patch machines, band wheel grinders, segment grinders, band saw swages, swages of all kinds, swage shapers, swage hammers, gauges of all natures, knife grinders, two-wheel grinders for high speed steel knives, balancing machines, and other innumerable lines, 224 pages in all being shown and well illustrated throughout.

The American Mining Congress economist states that gold production has declined from $101,000,000 in 1915 to $58,500,000 in 1919, and probably will be $40,000,000 in 1920.



ARRANGEMENT NO. 3—METHODS EMPLOYED IN MACHINING THE SECTOR.

Do You Safeguard Your Existing Equipment?

Accidents Can Be Reduced to a Minimum by Guarding Moving Parts of Your Machine Tools—This Applies Especially to Existing Equipment, Which May Have Been Manufactured Before Guards Were Considered Essential.

By J. H. MOORE.

THE splendid results accomplished by safety engineers within the past few years have shattered, beyond shadow of a doubt, the old fallacy that accidents occurring while at work were necessarily incidental to industry. No longer do we believe that a certain percentage of casualties is inevitable.

Not only has it been shown that accidents are preventable, but that, apart from being the humane thing to do, the very prevention has been profitable to the firm concerned. Take, for example, the power press. This type of machine was responsible, year after year, for the maiming of thousands of employees, and the position of press operator was an exceeding hazardous one. But conditions have changed since the installation of efficient guards, and at the present time a tour through any up to date press room is a pleasure. Should an operator lose a finger these days the cause can usually be traced to rank carelessness on his part.

These same conditions exist in many other lines of industry, and machines in general are better guarded than ever before. Mr. H. A. Schulf, of the U. S. Steel Corporation, speaking upon the subject of safeguarding machinery at its sources, remarked as follows: "We have but to turn to the advertising pages of our technical journals, where page after page shows machines pictured with hazardous points guarded. True, the guarding is not always adequate, some parts being exposed that shouldn't be, but we cannot afford to be too critical. Think of the advertising pages of 10 or 15 years ago. In those days the gears, power transmission, etc., were devoid of any covering."

It is obvious that the best time to safeguard a machine is while it is being designed, for we can then incorporate the features essential to safety, at the same time producing a design that is pleasing to the eye. This, however, is impossible in the case of machinery built 10 years ago, but that fact need not deter one from installing guards on these early models. True, they may not look quite as neat, yet neatness is a secondary consideration alongside of safety. The chief point to watch is this: Make the guards as complete as possible, and of good stout construction. A frail guard never was a success.

Safeguarding Existing Equipment

To illustrate what can be accomplished in safeguarding existing equipment we have selected four views from the plant of the International Harvester Co. at Hamilton, Canada. This concern has made a very careful study of the safety question, and have at each of their plants various safety experts who make it their chief business to design and instal adequate guards in all departments.

It is, of course, impossible to show even a small percentage of these guards, but we have contented ourselves with the four views depicted herein. Take for example Fig. 1. This photograph shows a portion of one of the aisles running through their woodshop. Note the guards at every machine, each being of a standard style. This is a feature well worthy of consideration, because by so doing they reduce the expense in making. In some cases the guards are made in standard sections, then bolted together as required. The aisle space in this photograph was not specially prepared for the occasion, but represents how the aisle is kept clean at all times. There are no chips, shavings, or dust to be seen, and the reason is self-evident. Every machine is equipped with dust and shaving removers, the material being sucked up the pipes, going from there into a huge hopper.

Fig. 2 illustrates a close up view of one of these guards, and its construction can be clearly noted. The framework is 1¼-in. angle iron, while the lattice work is usually ⅛-in. to 3-16-in. thick, and ¾-in. to 1-in. wide. Note that certain portions of these guards are hinged, so that they swing out to allow repairs to the machine if necesary. A castor is placed at the bottom of the legs in some instances, as for example at A and B in the present photograph. The method of holding these sections in place is the same as used on any gate, and this part can be noted at C.

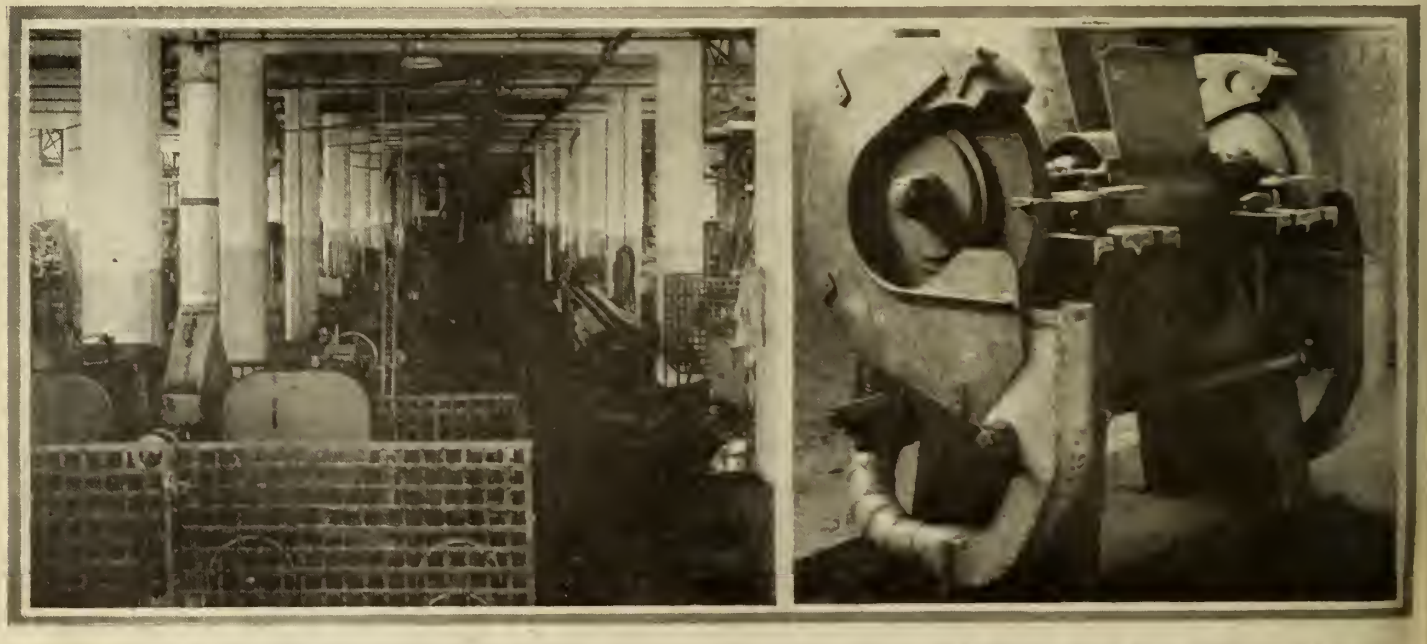


FIG. 1—NOTE THE CLEAR AISLE SPACE AND WELL-PROTECTED MACHINES.

FIG. 4—ONE STYLE OF EMERY WHEEL GUARD AS ADOPTED AT THIS PLANT.

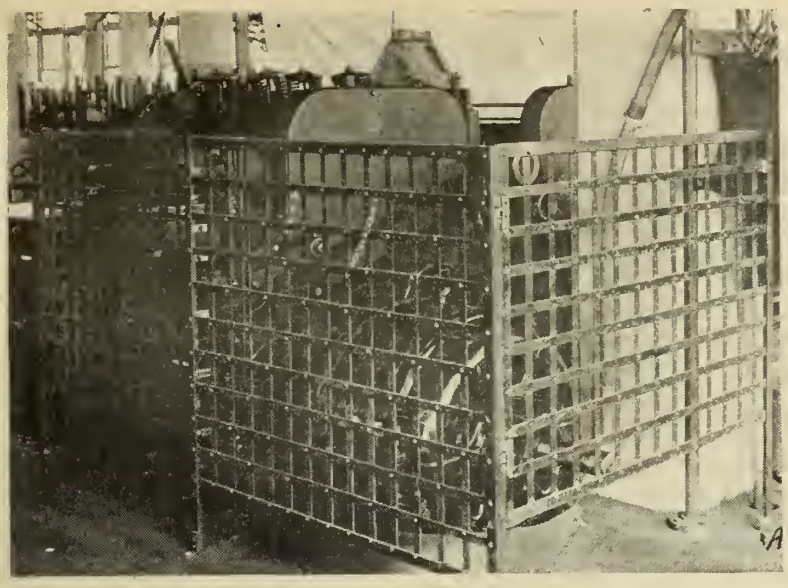


FIG. 2—CLOSE-UP VIEW OF ONE OF THE GUARDS.

The third example, Fig. 3, depicts a safety device installed on a rip saw. This particular work is of the following nature: The board and its proportions can be clearly seen. In the centre of the board there is a slot, but only for a certain length. This means that the saw has to be fed up vertically into the board after it has been placed in proper location to the saw. Before the installation of this guard, accidents were frequent, but by placing the device on the machine no further trouble has occurred. The complete attachment cost but a trifle, yet its results are satisfactory in every way. While on the subject of expense, it might be well to state that it is not always the most expensive guard that is the best.

The chief aim in the design of any guard should be simplicity. It stands to reason that the simpler it is the less expensive it will be, and this is not the only advantage. Give a workman an intricate, elaborate safety device, and he will distrust it. He will swear that it holds back production, and will have every possible excuse why he should not use it.

On the other hand instal a simple, yet efficient guard, explain the reasons for its installation, then watch the difference. It pays to take the workmen into your confidence. This statement may sound unreasonable to some, yet to prove its truth we quote the following experience of a large institution that decided to go into the matter of safeguarding all their presses. Their accident toll was very heavy, and they were, to say the least, worried about it.

Believing that what they did with their equipment was entirely their own business they proceeded to design and instal guards on all their machines. Imagine their surprise to find that the employees practically refused to use them, contending they would hinder production, thus reducing their wages. The development of this attitude was entirely unlooked for, and things were at a merry pass until the manager struck on the happy idea of getting the employees together for a heart-to-heart talk.

This was done, and at the talk he explained why the safeguards had been installed. Figures were quoted to show the extent of the accidents and the dire need of reform. "The idea is not a selfish one," he said, "but one that is for the workers' particular benefit. It cost real money, and lots of it, to put these guards in place, and our chief desire is to lower the accident hazard. Production will not decline, but will actually advance by the addition of these guards if you give them a fair trial. The very fact of their being there gives you confidence to work, knowing the punch cannot catch you unawares."

To make a long story short, the employees, approaching the matter in an entirely different spirit, found that what the manager had said was true, increased their production, and even went so far as to offer suggestions for further guards and improvement. Thus by taking the workers into their confidence this concern reduced their accidents from 120 to nil in one year.

Saw Guard

To proceed, however, to a description of Fig. 3. A is merely the gauge to which the work is held and there is another stop, not shown on the photograph, to locate work in opposite direction. B is simply a box inverted to protect the worker from the rising saw. The workman places the board to both gauges, presses his foot on lever shown, and up comes the saw.

An elaborate fixture on this work would have been superfluous, but by keeping to simple bounds the task is accomplished at practically no expense worth speaking of.

The last example, Fig. 4, depicts one of the styles of emery wheel guards adopted at this plant. They are of the dust-removing type, being connected up to the exhaust system in the usual manner. The guard is entirely home-made, and while not very classy to look at, or very elaborate in design, it accomplishes its purpose.

We leave the article at this point, not because the subject has been exhausted, but in the belief that sufficient has been shown and said to start the germ of thought working. Think to yourself, "Is there any machine in our plant that needs guarding?" Then, if there is such a machine, get it protected before it slips your mind. Accidents always remind us of this need, but it is better to lock the stable door before the horse departs.

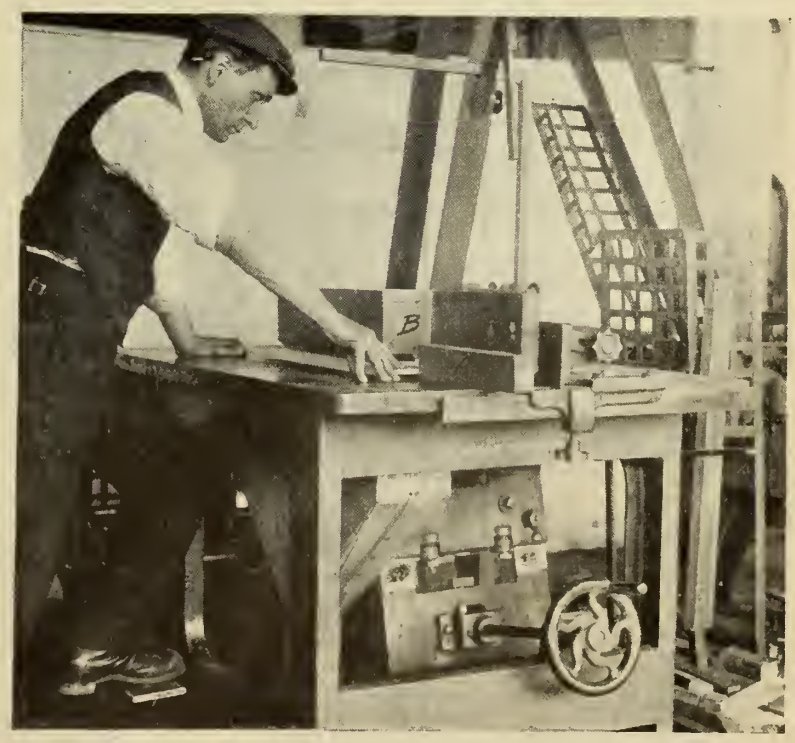


FIG. 3—A NOVEL AND SIMPLE FORM OF SAW GUARD.

Hardening Screw Gauges With Least Distortion

How to Harden Screw Gauges With the Least Distortion Along the Pitch Line—That Was the Problem Confronting the Above College, and Herein is Explained How the Work Was Accomplished

By WILFRED J. LINCHAM, Goldsmith's College, London.

THE first law of hardening (known for many years) asserts that sudden quenching after heating retains the steel in the condition that prevailed at the quenching temperature.

The second law of hardening (of much more recent discovery) states that quenching, while crossing an arrest or recalescence point, produces the least amount of distortion, and it is one of the purposes of this paper to endeavor to prove the truth of this law. A second reason for the paper is to offer the author's results to other screw-gauge manufacturers for their immediate assistance.

The second law had already been used by other investigators and practically applied with material success, but the author was unaware of the exact researches that have led to the adoption of fixed temperatures. The Wild-Barfield process he believed to be the first practical example, the principle of which is to use the change in magnetic properties of wrought iron or steel when passing from the β to the α state to indicate the temperature at which to quench. Reference to the Roberts-Austen diagram, Fig. 1, shows this to occur along the Ar2 line, temperature 765 to 770 deg. C. (1,409 to 1,418 deg. F.).

The Horstmann Brothers arrived at a similar result by quenching at 700 deg. C. (1,292 deg. F.), which is the temperature of the eutectoidal line Ar1. The screw gauges they manufactured were produced, they said, with no alteration in pitch, but a slight swelling always occurred in diameter, which was lapped down afterward. They kindly communicated their method to the author, who thereupon decided to make his own investigations, the results of which are now set forth.

The author's first-sought ideal was a quenching temperature which would produce no distortion whatever, but it will be seen that this has not been achieved, nor does it seem likely that anything more than a minimum distortion can be arrived at. The Ar1 line for the use of the second law appeared to have manifest advantages over that at Ar2 because of its constancy of temperature over a large range of carbon percentages; and it seems reasonable to expect that steels of any carbon content will act in the same manner when cooling across this line, if all are free from impurities.

Before the war the manufacture of screw gauges was confined to the use of high-carbon steel, say, from 0.85 to 1.2 per cent. carbon, which was usually left unhardened, on account of the difficulties caused by distortion on quenching. The making of hardened screw gauges had been practised to a very limited extent before 1914, the correction after harden-

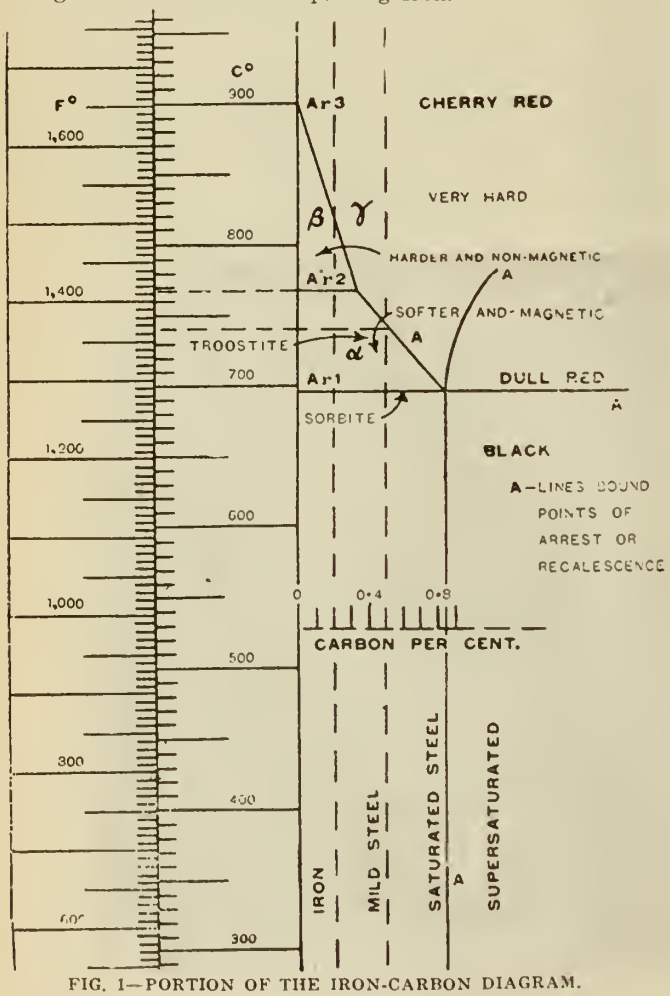


FIG. 1—PORTION OF THE IRON-CARBON DIAGRAM.

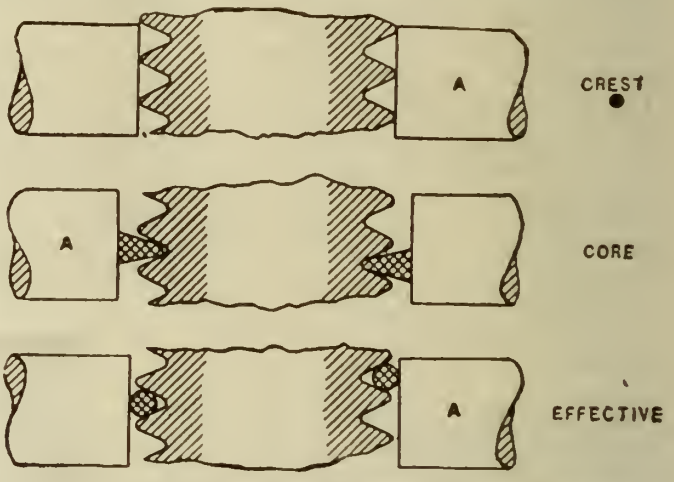


FIG. 2—MEASUREMENT FOR DIAMETER AAA—MICROMETER ANVILS.

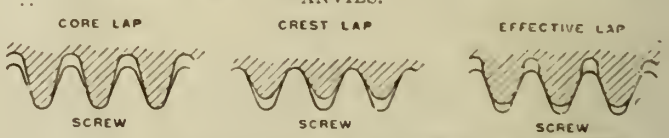


FIG. 4—LAPPING THE SEPARATE ELEMENTS OF A SCREW.

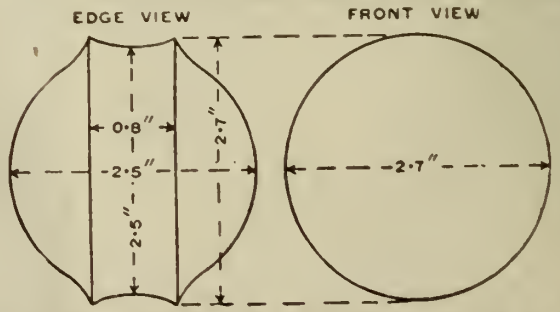


Fig. 5—A disk of mild steel $4\frac{1}{4}$ in. in diameter, and $1\frac{1}{2}$ in. thick originally was swollen as shown by means of 1000 successive heatings and quenchings. Original volume 21.28 cub. ins. Final volume 21.00 cub. ins.

ing being obtained by the use of laps of cast-iron or boxwood. The method taken generally has now been revived and extended, and is the only one followed at the present time, so a short description will be useful in order that the author's intentions may be understood.

Assuming that the gage can be hardened with so little change that the pitch tolerance, plus or minus, is not exceeded, which it will be shown can be done, the process of making a gage involves, first, the accurate screwing of the blank, and then hardening the screwed piece.

The first was carried out in a lathe accurately corrected in pitch by a cam bar. The screwing tool, known as a form tool, was of disk shape and supplied with chasing teeth on its circumference. Two of these "form chasers" were used, both being quite accurate in pitch and of perfect sectional contour for the thread to be cut. One was used to rough out the gage screw to about half or two-thirds the thread depth; and the other, very carefully adjusted in position, to finish the thread correct on core, crest and effective diameters and full form. Constant measurement was, of course, necessary, but as the lathe slides were provided with micrometer disks, rapid and almost automatic manufacture was soon secured. The intention of the author at this stage of the work was to just clean up the gage with a full-form cast-iron lap, accurately made from a tap cut in the before-mentioned lathe. This method of lapping proved a failure, the abrasive clinging to the soft gage and causing "scoring," so he fell back on the cutting tool itself for the accuracy demanded, assisted by the use of a very mild steel of 0.14 per cent. carbon for the blanks that cut with a polish. The object of the screwing operation was to produce a gage that was perfect in all dimensions while yet in the soft state.

The next step was to harden. The hardening of screw gages, and, indeed, some others, was performed in a cyanide furnace, made by John Wright, of Birmingham, which consisted of a rectangular cast-iron bath, covered and ventilated to remove the fumes, filled with sodium cyanide, and heated by coal gas and air, the latter being fed at a pressure of three pounds per square inch. The cyanide, which melted at about 600 deg. C. (1,112 deg. F.) and boiled at or near 800 deg. C. (1,472 deg. F.), was maintained at 750 to 770 deg. C. (1,382 to 1,418 deg. F.) when in use, the temperature being indicated by a thermo-couple pyrometer. The gages (of mild steel) were placed on trays suspended clear of the bottom of the bath and soaked from ten minutes to one hour, according to size, or until they had acquired the requisite depth of case.

The Cyanide Bath

If a greater depth of case than 0.005 in. be required, packing the gages with barium carbonate and bone black in closed boxes and soaking in a muffle furnace at about 850 deg. C. (1,562 deg. F.) must be resorted to, but the final heating should be completed in the cyanide bath.

It is possible to allow the cyanide bath to cool to the quenching temperature (supposing that to be exactly known) after the requisite soaking of the gage, but the process absorbs much time and increases expense, and is not to be advised for continuous working. Also the temperature may be ascertained by the color of the gage, which may be taken as a very dull red, but this is not advisable. The author therefore installed, in addition to the cyanide bath, a Brayshaw salt-bath furnace, using "pyromelt," and kept that furnace at the constant quenching temperature. This furnace was called the "store furnace," for when a gage had had its full time in the cyanide it was stored here at quenching temperature until its heat had evened up; and it was afterward quenched at leisure. The quenching tank was close to the store furnace and of ample capacity, with inflow and outflow cocks.

The screw gage was next measured for pitch and diameters. The diameter measuring machine has already been illustrated in the Proceedings, 1917, page 54, and Fig. 4, page 55, and the mode of its use is merely suggested in Fig. 2 (page 5), which shows the micrometer anvils at the moment of measurement.

The Pitch-Measuring Machine

The pitch-measuring machine, Fig. 3, was designed by the National Physical Laboratory and constructed at Goldsmith's College. The drawing is somewhat diagrammatic in order to show the principle clearly. The gage is supported between centres on the main or fixed casting. A movable carriage supports an indicator on the left and a micrometer on the right, being always pressed leftward by means of a weight. The indicator carries a stylo, which engages with the screw thread, and a pointer in connection therewith, whose reading is

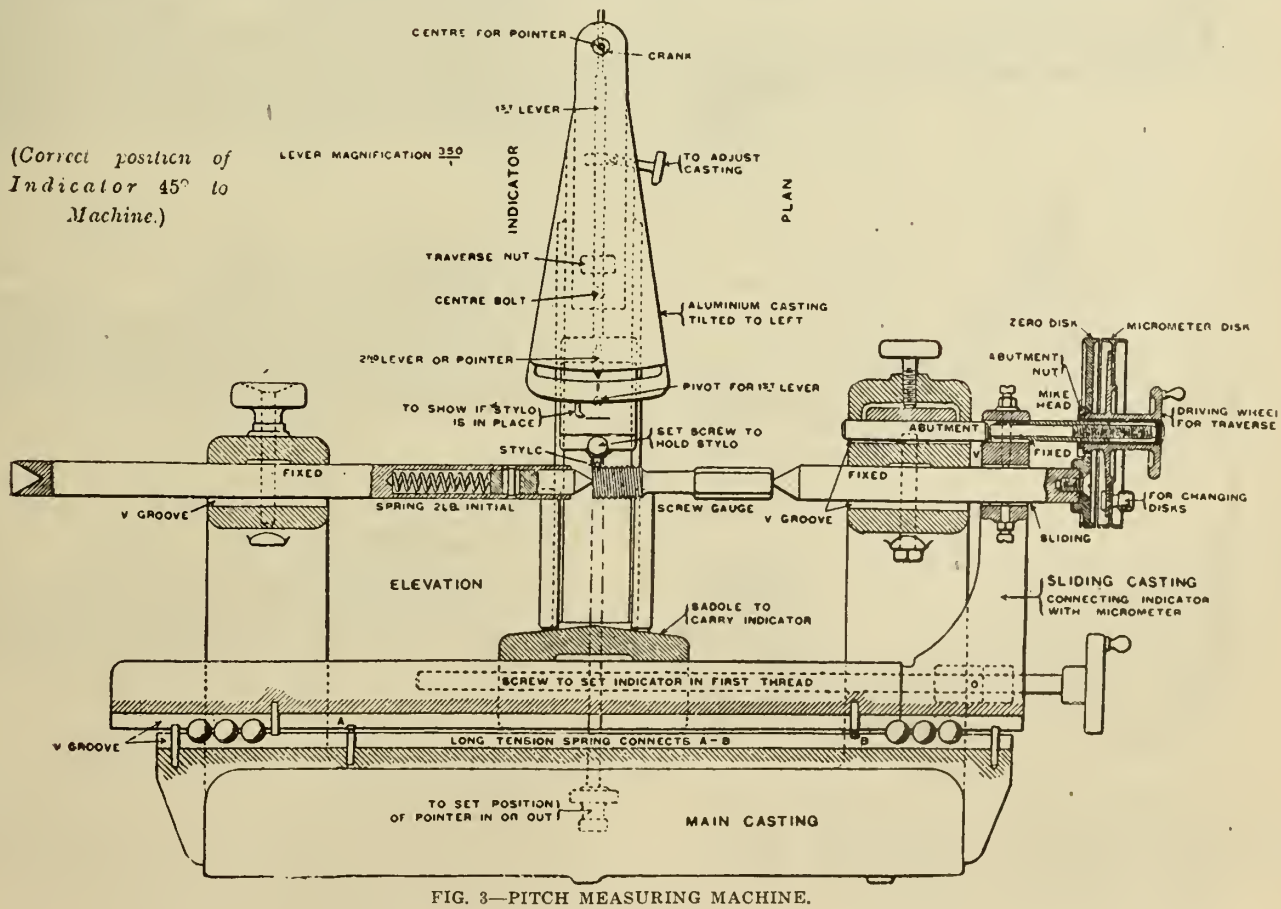


FIG. 3—PITCH MEASURING MACHINE.

multiplied so as to be in the region of one-millionth of an inch of sensitiveness. The micrometer abuts against the main casting and can be read to 0.000001 of an inch and very rapid charting of screw errors can be obtained.

After hardening, it was found that the screw pitch had not distorted beyond the tolerance, plus or minus, if precautions had been taken such as suggested later. The diameters, however, had increased, at least the core and crest were larger, but the effective surface was often unchanged. The operation of lapping followed, three laps, Fig. 4, being used; but the enlargement being only about 0.0001 to 0.0003 in. in diameter, the amount of lapping was very little. Naturally the operation was of a delicate character, and was the particular part of the whole process that most held up delivery; many gages were spoiled in its exercise; but it is believed that the whole hardening process will yet be so perfected that only a full-form cleaning lap will be necessary.

Gages Examined by Optical Lanterns

Finally each gage was examined by an optical lantern magnification of exactly 50 to one, as already described in previous papers; and, of course, the pitch and the diameters at all three elements of section were thoroughly tested during the stages of manufacture and just before delivery, by a competent staff of examiners. It will be said that if only a screw gage could be made to travel through its various manufacturing steps in such a simple and well-oiled manner, the difficulties of screw gage making would be completely overcome. It is one intention of this paper to show that the difficulties of manufacture are being overcome by the adoption of definite scientific method, and there are strong and practically certain hopes of doing away with lapping altogether.

The crucial point of the manufacture is the hardening. Lathes have been specially built that will produce accurate pitch, and mild steel is being used that can be finished in those lathes with a polish. It will be shown that a quenching temperature can be found that only lengthens the pitch by 0.0002 in. over 0.7 in. of length, which is within the pitch tolerance, 0.0003 in., on such a length for inspection gages of correct effective diameter.

Two remarkable examples of distortion are shown. The first, Fig. 5, was, before treatment, a cheese-shaped disk of 4¼ in. diameter by 1½ in. thickness, of common mild steel. It was heated in a coke fire and quenched in water, the operation being repeated about a thousand times. The continued distortion has swelled the disk into an approximate spherical form, but that the volume is unchanged was ascertained by displacement measurement.

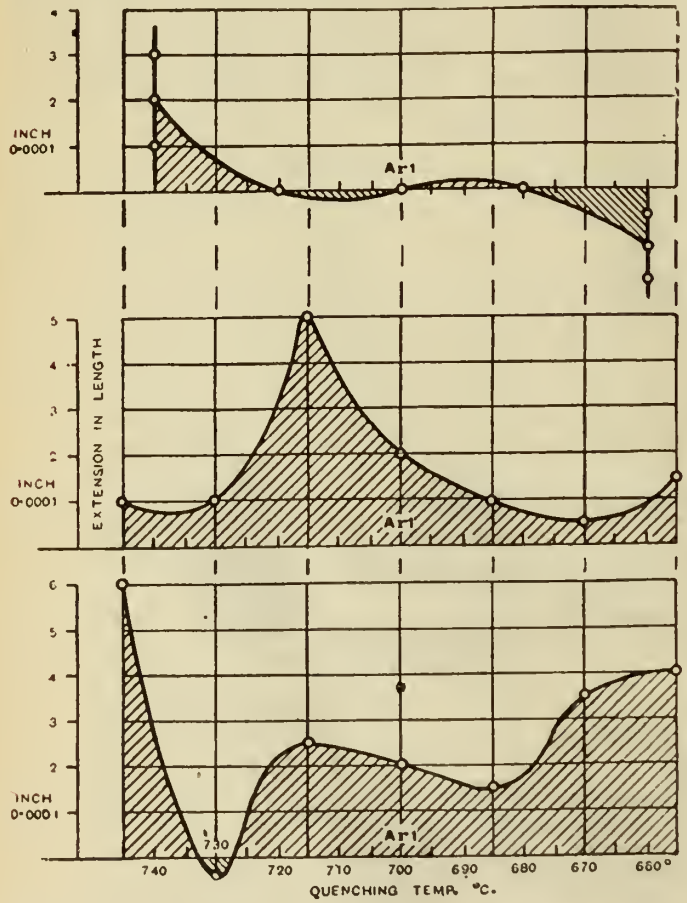
The second specimen, Fig. 6, was at first a rectangular disk, and here again the spherical form is attempted, the treatment being the same as in the first example.

These two specimens came to the author as a piece of exceptional good fortune, being presented by F. A. Thompson. Their history is: A garage boy required buckets of hot water at meal times and kept three of these pieces hot on coke fires, using which he pleased to heat the water by immersion, and continuing his unintentional experiments over a period of about a year.

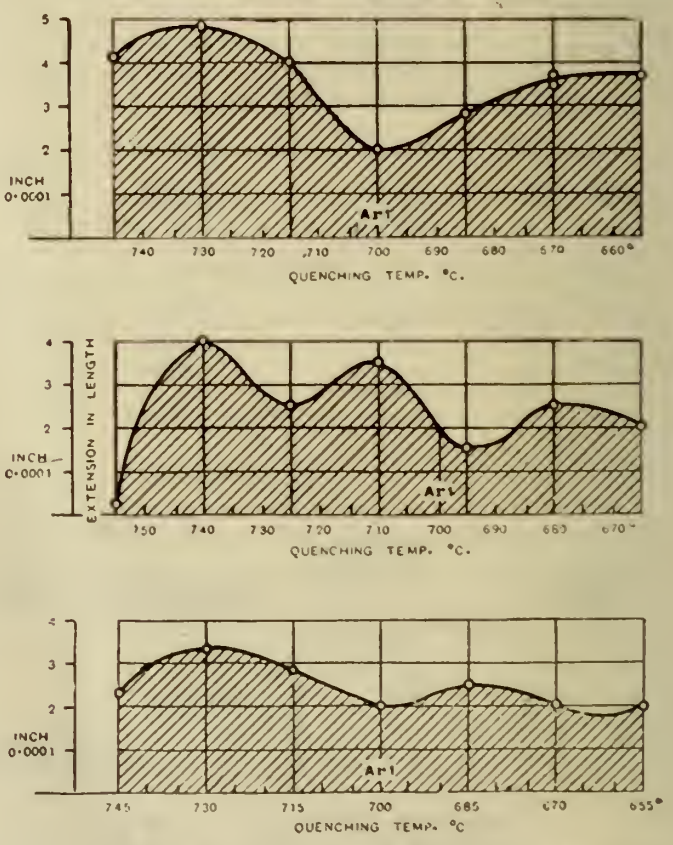
The author commenced his experiments in April, 1918, by providing seven specimens for each experiment, the material being J and L steel of 0.14 per cent. carbon. Each specimen was ground and carefully surfaced by stoning the ends, and the dimensions were about 9-16 in. in diameter by 0.7 in. long. Previous experiments upon pieces of full gage shape showed the wisdom of using simple cylinders for the temperature tests so as to obtain symmetrical distortions.

One form of distortion resulting from hardening a cylindrical piece of steel was found to be a swelling or bulging at the ends, but the length, measured at the edges, remained very little changed indeed.

The experiments were begun without any clear notion of the form the dis-



Figs. 7, 8 and 9—Experiments on distortion of screw gages in length only: viz.: On pitch line. J and L mild steel 0.14 per cent. carbon. Cased in sodium cyanide for 30 min. at 750 deg. C. Specimens 9-16 in. in diameter by 0.7 in. long. Fig. 7—Average change of length (measured over the end surfaces). Fig. 8.—Distortions all extensions. Fig. 9.—Curve which seemed to indicate no fixed law.



Figs. 10, 11 and 12—Experiments on distortion of screw gages in length only: Viz.: On pitch line. J and L mild steel 0.14 per cent. carbon. Cased in sodium cyanide for 30 min. at 750 deg. C. Specimens 9-16 in. in diameter by 0.7 in. long.
Fig. 10—Curve which indicates that 700 deg. C. (1,292 deg. F.) is the best hardening temperature. Fig. 11—Wavy curve with minimum at 795 deg. C. (1,283 deg. F.). Fig. 12—Minimum at 700 deg. C., but also at three other temperatures.

tortions were likely to assume, and axial measurements were at first made, which proved to be wrong for the purpose required. Also the ends of the cylinders were not parallel to less than 0.0001 in., and the average dimension was taken in the hard and in the soft states respectively. When, however, the circumference was divided into three or four parts and marked, and the change of length taken at the marked positions only and afterward averaged, quite consistent results were obtained, the figures fairly representing pitch line distortions on a screw gage.

Figs. 7 to 12 show, for six sets of experiments, changes of length in units of 0.0001 in. plotted on a base of quenching temperature.

Fig. 7 (April 5, 1918) is a record of the average change of length measured over the end surfaces, and contains the axial bulging. It was on this set that the bulge was first noticed, and from this time onward measurements were made on the edges only. The temperature of 700 deg. C. (1,292 deg. F.), however, is indicated as that of no distortion.

Fig. 8 (April 24, 1918). The distortions are all extensions, and 670 deg. C. (1,238 deg. F.) indicates least distortion. Several screws were hardened at this figure with success.

Fig. 9 (April 27, 1918). This curve was distressing. It seemed to show that there was no fixed law and that nothing would result from the labor. The figure 685 deg. C. (1,265 deg. F.) was taken as best, for the drop at 730 deg. C. (1,346 deg. F.) might not be trustworthy.

Fig. 10 (May 4, 1918). A good curve showing 700 deg. C. (1,292 deg. F.) to be decidedly the best temperature. Two specimens were quenched at 670 deg. C. (1,238 deg. F.) and are shown to fairly agree.

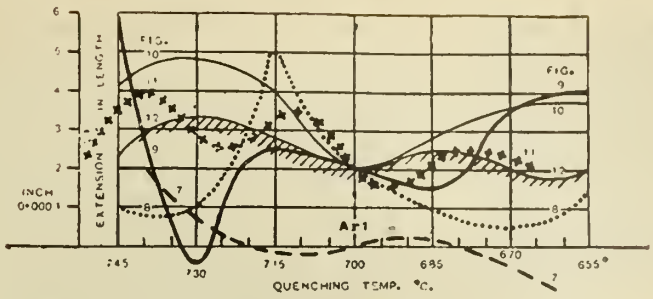


FIG. 13—SUPERPOSED CURVES OF FIGS. 7 TO 12.

Fig. 11 (May 9, 1918). Another wavy curve, with minimum at 695 deg. C. (1,283 deg. F.).

Fig. 12 (May 11, 1918). There is here a minimum at 700 deg. C. (1,292 deg. F.), but also at three other temperatures.

The problem, which now appeared hopeless, suddenly cleared itself. It occurred to the author to plot all the curves on one sheet by superposition, as in Fig. 13, and this operation was at once fruitful in showing that the distortion, or, as it may now be called, extension, had definite laws and was not the result of mere chance. Disregarding the first curve shown dotted, all cross at exactly one point, namely, 700 deg. C. (1,292 deg. F.), the recalescent point Ar1 of the equilibrium diagram. The extension is, unfortunately, not obliterated, but it has a fixed and definite value of 0.0002 in., and is within the tolerance limits. It indicates a condition of stability, and if 700 deg. C. (1,292 deg. F.) be made the quenching temperature, this extension can be allowed for when cutting the screw.

Other parts of the curves show nothing but instability. The use of the position 700 deg. C. (1,292 deg. F.) therefore is calculated to assist correct manufacture, while all the other temperatures are unreliable. On that account, an attempt to find a stable temperature of maximum extension, for use when needed, was practically unsuccessful; for gages quenched at 715 deg. C. (1,319 deg. F.) did not always extend well. A very important point is that the temperature must be found with accuracy, the range of stability being so very limited.

In Fig. 14 the distortion scale has been magnified and plotted for a range of 15 deg. ± of 700 deg. C. Maximum instability occurs at 715 deg. C. as well as maximum distortion, and in all cases temperatures below 700 deg. C. are safer than those above. A fair and safe latitude for quenching lies between 690 deg. C. (1,274 deg. F.) and 700 deg. C. (1,292 deg. F.).

The author found no difficulty in making sure of 700 deg. C. with the use of a platinum-rhodium thermo-couple, a thermometer within a galvanometer-case giving warning of any change of temperature of the cold junction. Upon retesting the thermo-couple after about six months' use it was found by the makers to be quite accurate.

It now appears that the second law of hardening proposed at the commencement of this paper is proved so far as the line at Ar1 is concerned, and could no doubt be proved for other arrest points.

In the early stages of this research

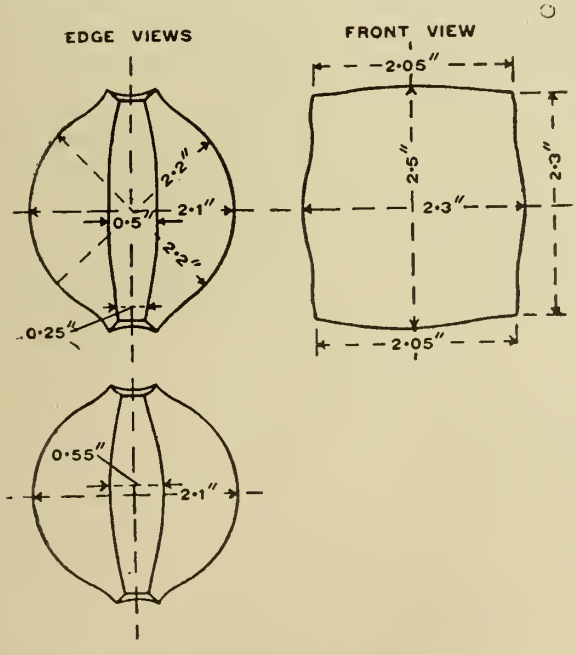


FIG. 6—RECTANGULAR DISK OF MILD STEEL WAS SWOLLEN AS SHOWN BY MEANS OF 1000 SUCCESSIVE HEATINGS AND QUENCHINGS.

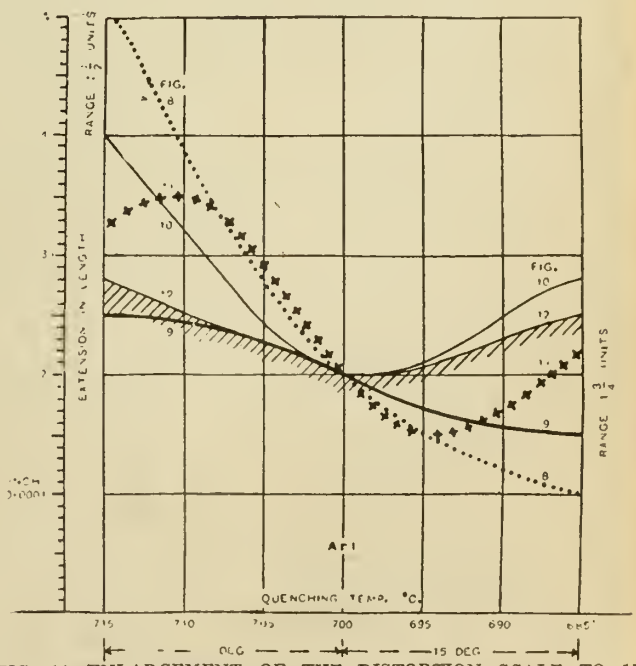


FIG. 14—ENLARGEMENT OF THE DISTORTION SCALE TO 15 DEGREES ABOVE OR BELOW AR1.

measurements of distortion on diameter were made, which always showed an increase of about 0.0001 to 0.0003 in., but the purposes of the research being the measurement of length distortion in screw gages, and time being pressing, diameter measurements were not proceeded with.

Before obtaining the pyrometers, which were not in use before April 5, some experiments were made on a color scale extending through

Bright red
Gray just appearing (due to freezing of the cyanide)
Full gray
Dull red
Black just appearing
Mid black
Full black

the specimen being held in a half light. The results pointed to a best temperature between dull red and black just appearing. Some experimenters have further perfected the color test, but the author considered the pyrometer method undoubtedly superior, and with his system of two furnaces could be practised by a somewhat unskilled operator.

Further experiments are needed on ring gages, which have laws of their own as regards diametric distortion, and the author had hoped to make experiments on other gage shapes.

It has not been exactly discovered what the first stages of distortion assume, for in the boy's experiments the diameters are all decreased, though it is certain they increased at first. It was believed that a barrel shape was first produced, coupled with end swelling, but careful test has shown a festoon shape on the rim, and it must be always remembered that nature insists on keeping the volume constant.

Instead, however, of waiting till all these facts could be obtained, it appeared wiser to make known the results that had already been acquired, in order that screw gages might be produced more easily and accurately by every manufacturer in a time of need.

The fact of the emulsive constitution of steel at Ar1 led the author to believe that gages quenched on this line would not be thoroughly hard. He was glad to say that, on the contrary, he had found them in every case to be glass hard. It must not be forgotten that the process of hardening by casing in cyanide produces a high-carbon steel at the surface, while the interior remains in the mild state, and this may have something to do with it.

The most important of the conclusions arrived at in this paper are:

(a) The second law of hardening is proved.

(b) A temperature of minimum distortion that can be relied upon is 700 deg. C. (1,292 deg. F.).

(c) No variation is allowable above 700 deg. C.

(d) An allowance of 10 deg. below 700 deg. C. is practically permissible.

THE PETROLEUM SITUATION IN THE CAUCASUS

The scarcity of the petroleum oils and the rising prices of the same in this country give a special interest to a report that has been made on the petroleum situation in the Caucasus by M. Aldebert as published in Le Geine Civil.

Communication with the oil regions of the Caucasus, which was becoming more and more difficult since 1914, was cut off entirely in 1917 because of Bolshevism and the Turco-German occupation. At the present time we are still very poorly informed on the subject. Widely different and contradictory reports are in circulation, and the report of M. Aldebert sets out to classify the situation as it existed on January 1, 1920.

Almost the whole of the Russian oil production comes from the Caucasus. In 1916 this amounted to about one-sixth of the total production of the world, and ranked Russia as next to the United States as a producer of mineral oil.

Although the Caucasus forms a continuous oil-bearing basin, for indications are found upon both the northern and southern slopes of the mountains, M. Aldebert divides the territory into three sections where the principal developments are concentrated:

1. The Maikopp section, which yields about 1.2 per cent. of the Russian output.
2. The Grosny section, which yields 17 per cent.
3. The Baku section, yielding 78 per cent.

In the Maikopp section, which is divided into three groups, there are 138 wells, of which only 38 are worked. These have a daily yield of about 67,000 gallons. The principal group at Maikopp is connected with the refineries at Ekaterinodar by an 8-inch pipe line about 87 miles long. The other two groups are connected by pipe lines to the tanks on the Ekaterinodar and Nova-Rossisk railway. The production of the Maikopp section rose from 503,000 gallons in 1908 to 47,140,000 gallons in 1912, but fell to 10,309,000 gallons in 1916, while in 1919 the output had again risen to 15,400,000 gallons.

These operations have suffered very little from the war, being situated in the centre of the provinces of Couban and Tereck, where the population is Cossack and, from the very outset of the revolution, have resisted the Bolshevik movement and have made up the nucleus of Denikine's army.

At Grosny the section is divided into two parts, that of the Old and New Rayon, located at a distance of about 9 and 3 miles, respectively, from the city. The operations at Old Rayon have not been destroyed, either by the revolution or the uprising of the populace, but at New Rayon the operations have been almost totally destroyed.

In November, 1917, seven flowing wells were fired and burned until February, 1919. Some of these wells had a yield of more than 283,000 gallons a day. An immense layer of lava produced by the burning oil covers the slopes of the hills to a depth of more than a foot. This lava consists of a petroleum coke and is actually used as a fuel under boilers. The wells which were not burned were destroyed with the axe and dynamite.

At New Rayon, out of 122 wells which existed before the revolution, only 5 are now being worked; 7 are being repaired, while the others are idle or have been abandoned.

The operations of the Grosny basin were begun in 1896, and grew continuously, except for a slight fluctuation during the first revolution of 1906, and reached a total yield, in 1917, of 550,300,000 gallons; but it would have reached 786,000,000 gallons had transportation facilities been sufficient.

In addition to tank cars there were 8-inch pipe lines leading from the district to the Caspian and Black Seas which, before the war, had a daily capacity of 10,310,000 gallons, while to-day, after repairing the pipe line destroyed in 1917 and the two pumping stations out of four, the capacity is only 471,000 gallons a day.

At Baku the production of the Akcheron peninsula, which was 258,000,000 gallons in 1882, steadily increased until it reached its maximum of 3,457,000,000 gallons in 1901. The revolution of 1905 cut the production of this section down to 2,106,000,000 gallons, but as matters became settled it rose to 2,467,000,000 gallons in 1916, although the scarcity of repair parts, machinery and material began to make itself felt in consequence of the war and the closing of the Dardanelles. The year 1918 brought in anarchy, and industry was completely paralyzed.

The year 1918, with a production of 630,000,000 gallons, saw the nationalization of the petroleum industry, followed by a Turkish occupation after several days of bombardment with its horrors and massacres. The economic disorganization is complete; there are now neither new operations nor exportations, and output is reduced to a minimum, so that we have to go back to 1889 to parallel it.

At the end of 1918 English and Russian troops occupied Baku anew. It had suffered from bombardment, but the operations were intact.

In 1919 a Tartar government was established, which later became the Republic of Azerbeidjan and was actually recognized by France. When order was established in August, 1919, the English evacuated Baku and, contrary to the forecasts, there were no massacres and no disorder.

But oil production was reduced to a minimum because there were almost no exportations, Astrakan being in the hands of the Bolsheviki, and Astrakan, before the war, handled about 75 per cent. of the Baku exportations.

In order to span this crisis the government advanced money to the operators in order to enable them to carry forward new operations, but as the tanks are full the situation is a difficult one. The ex-

(Continued on page 64)



WHAT OUR READERS THINK AND DO



DOUBLE FACING TOOL

By F. SCRIBER

To reduce the time required for facing discs which were held in a chuck in a lathe, the tool holder shown in Fig. 1 was used. The fundamental feature of this is that one tool (say for instance A) is set for rough facing, while tool B is set so it will face to the finished size. Having these two tools A and B set in the block C they are clamped securely thereto by the square headed screws shown. The necessary top and side clearances are ground on these tools, so they need not be set on an angle. The other units are provided to bring the tools successively into position for doing the facing, in other words the block complete with tools is mounted on a cross-slide of a lathe with tool A set for roughing size. The tool is then fed across the work in the usual manner thereby completing the roughing out. After this nut D is loosened by the operator, which allows block C to be lifted above tongue E by means of spring F. The block C is then turned by hand quarter way around, bringing tool B into position now occupied by tool A, and the finishing cut is taken across the work after tightening nut D, which compresses the spring and holds block C tight in position.

The various details which are used in this connection have been shown below

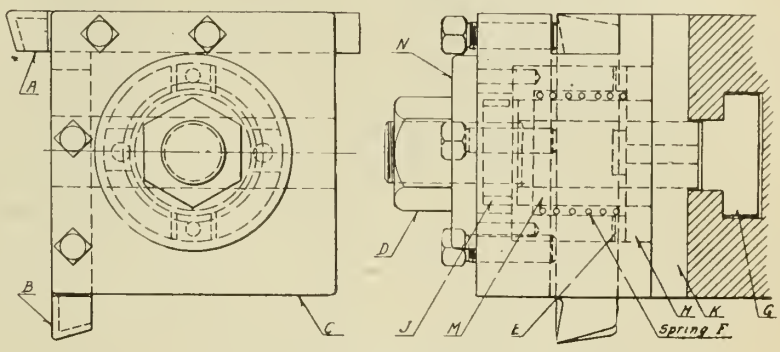


FIG. 1—THE ASSEMBLED TOOL READY FOR USE.

the assembly in Fig. 1 and in Fig. 2. These consist of a centre stud which is used in the centre of the block and holds the various members in place, a locating block H upon which the spring rests and above which the block is centralized by locating sleeve I and a clamping nut J used inside the swivel block C, the base block K is shown in Fig. 2, upper right-hand corner. Over this is slipped the swivel block C with locating sleeve I and block H between them.

When assembling this tool, locating block H is pinned to base K, tool-carrying block C has locating sleeve I pinned to it, clamping-nut J is screwed over centre stud G with a spacing collar M, which is not detailed between it and locating block H, thereby holding base K securely to the lathe cross-slide and locating it square by means of the tee section of the bolt in the cross-slide tee slot. Tool-carrying block C with locating sleeve I pinned to it is next put in position with spring in place, following which washer N is put over the centre stud. The nut is put in place and the arrangement is used as previously described. This type of block could also be arranged for turning by suitably locating the cutting tools.

It will be obvious from this description that loosening the hexagon nut D about one revolution allows the swivel block to lift the tool-carrying block clear of the tongue on the locating block thus allowing the swivel block to be turned the necessary amount.

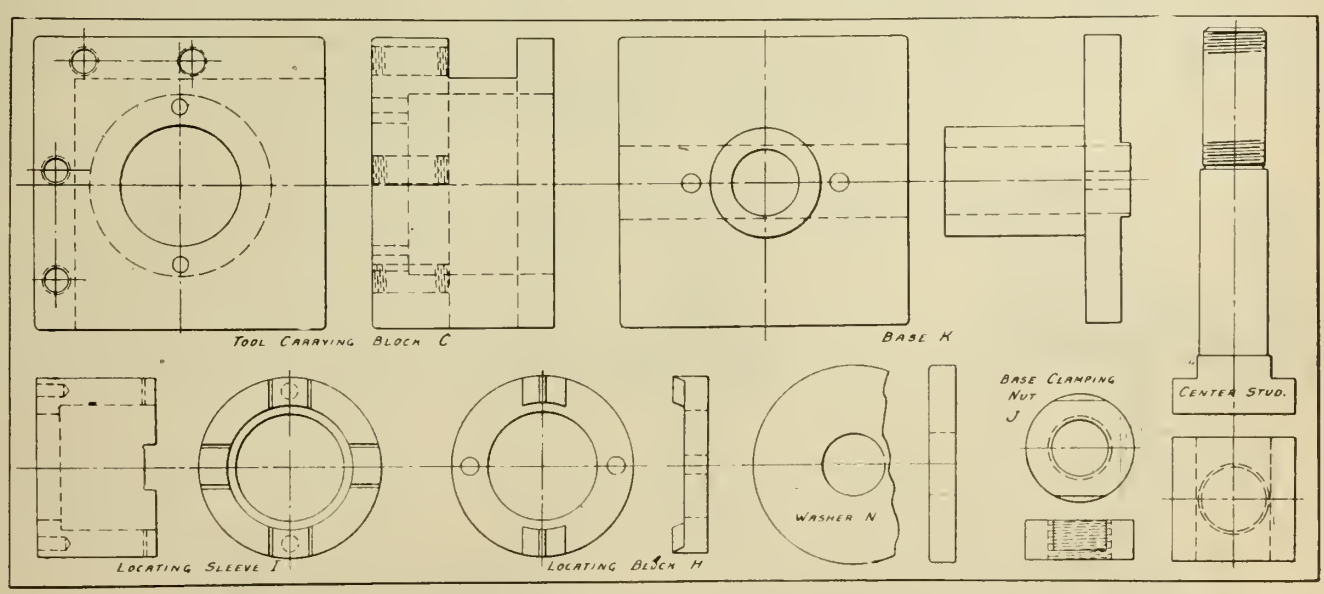


FIG. 2—ILLUSTRATING THE VARIOUS DETAILS OF THE TOOLS.

MACHINING ROD BRASSES

By Clyde D. Thorburn

For a considerable period we have been up against it for a quick method of machining the strap fit on main rod and side rod brasses. At one time our small crank planer worked about sixteen hours per day and could keep up with amount required, but with an ever-increasing demand for these brasses it was deemed necessary that we should endeavor to find some quicker means of production.

We used a long angle plate on planer and set up a row of brasses against it, but with the extra setting required we did not gain anything on cost of machining. In these days of high rates of pay it becomes more and more necessary for us to cut down cost of production, and as is well known, suitable jigs not only mean a reduced cost but uniformity of pieces and more per day.

Jigs as shown were designed specially for this purpose, and we expect to gain these favorable results. The jig is designed to suit a Bateman high-speed planer and to hold 10 brasses (5 on each side, two heads working). The body A is a double-angle plate, planed on base B to suit table of planer, and on both outside and inside faces. In the outside faces 5 holes 3 in. x 1 in. deep are bored at suitable centres (according to the size of our largest brasses) for cones C to fit into, and further holes tapped 1½ in. diam. to take studs D, which hold the step cones in position. Directly above these stud holes five more holes are drilled to take the sleeves E containing the locating pins F and springs G. Step cones are made of cast iron, and sizes of steps correspond with all our common classes of brasses.

Across the face of each cone four centre lines are cut to enable jobs to be set quickly and without the aid of surface gauge. In these cones four ¾ in. holes are drilled right on dead quarters to take end of locating pin. This is for brasses having four square sides. For brasses having one or more sides taper, other holes would have to be drilled in cones to give that correct taper.

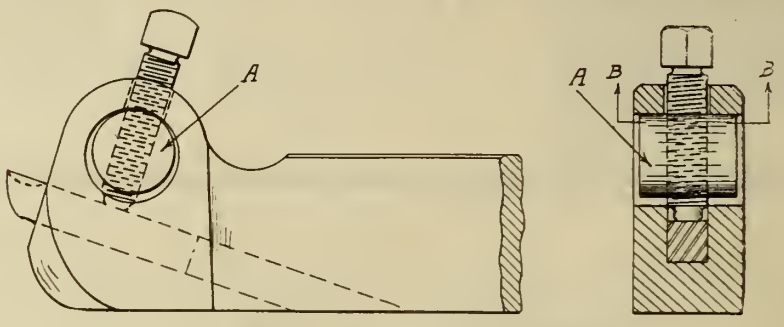
Brasses are faced on both sides and bored out to standard size. If bore is not required to be standard or probably left rough, these brasses would only be bored ¼ in. deep, or sufficient to fit on cone. Before brasses are bored they have previously been sweated together. In setting brasses on jigs, planer hand must see that joint of same is right on centre line marked across the face of cones. He applies the big washer H (which has a slot extending from centre hole to outside diameter to enable quick application and removal) and tightens up, only having one nut on each brass to tighten. An ordinary brass roughing tool will be used for planing between flanges, and a square nose-finishing tool to plane down inside of each flange. Probably a square nose tool would do the complete operations if the amount of stock is not too great. The first side of brass machined, all that is required is to slacken the nuts on inside of jig, pull back the locating pin and revolve cone until locating pin falls into next position. A small jack I is used (made of a nut and set-screw) under front end of brass to prevent a possible slipping of brass on cone. This jig practically eliminates the setting, previously a part of the operation that accounted for a lot of time.

During 1919, France, England and Sweden were the principal buyers of cash registers, which, together with parts, amounted to $4,375,526.

MODIFIED TOOL HOLDER

By Tyke

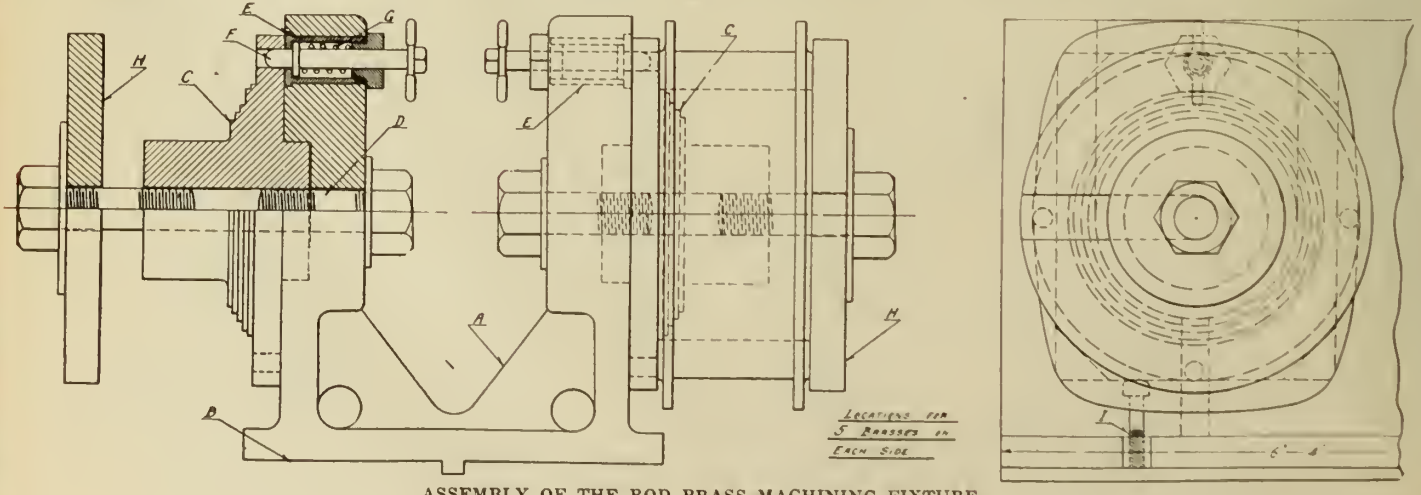
Time in a small shop is of vital importance, but no matter how careful one is small tools are very apt to get—well not exactly lost, but very badly misplaced. This is especially true when any device is made up of two or more loose pieces. These are liable to be dislodged by vibrations or shocks. Such an occurrence happened the other day and the part lost was the cam out of a tool holder.



DETAIL VIEW OF THE TOOL HOLDER.

Tool holders when desired are wanted at once, and mean lost money. The holder and wrench were located in their customary places, but the cam had vanished. After considerable time had been spent in the usual shop hunt for the lost parts, it was decided to improvise. When looking at the main body of the holder and seeing only a hole instead of the familiar cam it looked almost hopeless, but after a few minutes' cogitating a very simple, practical and efficient method was decided upon.

A piece of 3-4-in. cold rolled steel about 7-8-in. long was cut off, drilled and tapped for a standard 3-8 set screw. The upper portion of the tool holder was drilled 13-32-in. and the job was completed. The cold rolled piece "A" was placed in the hole and the set screw inserted and screwed home. It will be clearly seen that as soon as the set screw bore down on the tool bit the piece "A" rose in direction of arrows "B" until its progress was arrested by the upper part of the hole, after which the tool bit proper received the full pressure exerted by the set screw.



ASSEMBLY OF THE ROD BRASS MACHINING FIXTURE.

Would You Like to Receive One of These Scales FREE?

You can do so very easily, at the same time increase your knowledge and powers of perception.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

Rules of the Contest

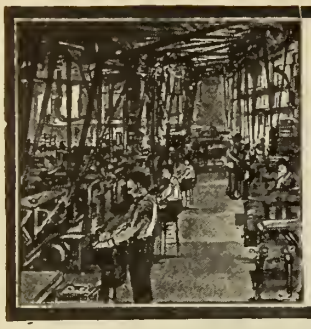
The answers to this novel contest continue to pour in, and for the benefit of those who do not understand its value and scope let us explain. Every week we publish a list of puzzling queries similar to those below. It is up to the reader to read the query, turn to the advertising pages, and find the firms we refer to. These puzzling references are interesting to follow, and will quicken your powers of perception. It costs nothing, you get acquainted with the different lines, and have an opportunity to win a prize worth while.

The Lucky Prize Winner for Nov. 4th Issue List is GEORGE PILGRIM, Box 407, Dundas, Ont. He Had All Answers Correct.

INTERESTING FACTS TO BE FOUND IN THIS WEEK'S ADVERTISING SECTION

1. Something that wins friends even under adverse conditions.
2. A product that is shipped in four ways.
3. A machine that tells the cold blooded truth.
4. How to assure accuracy.
5. A machine that will produce two distinct classes of work at the same time.
6. An interesting operation economically performed.
7. How to save time, labor and money.
8. A product that is said to be breaking production records.
9. Something that can be cast quickly and at slight cost.
10. A product that can be made to meet individual requirements.
11. A book is often dull, but somewhere in this issue we read of another article that gets dull, and like the book, should be laid aside. What is it?
12. Something about a machine that when it is in place is as firm as the spindle itself.

Make a Start and Send in Answers Promptly. Closing Date for This List is Dec. 9, 1920



DEVELOPMENTS IN SHOP EQUIPMENT

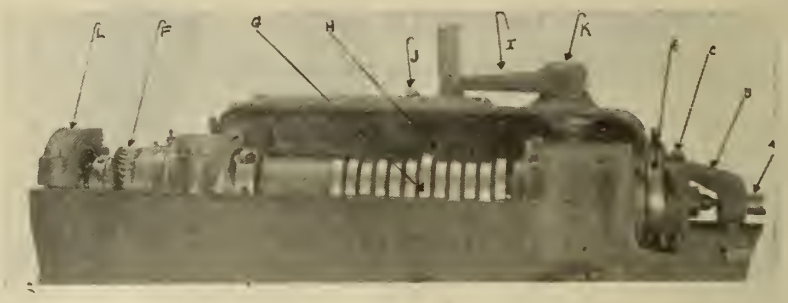


CAM-GRINDING ATTACHMENT

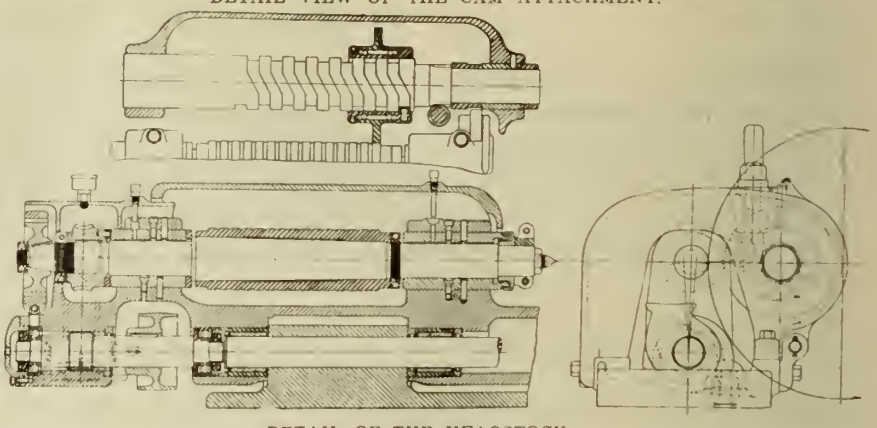
In designing cams of various shapes for automobile crankshafts, the tolerance has gradually been reduced so that grinding machines are called upon to produce many difficult shapes to meet the requirements of accuracy. In order to obtain a silent cam, clearances have been reduced and at the opening and closing points in some cases there is a slight rise in a number of degrees; for example, 0.005 in. in from 20 to 25 degrees. To provide for these requirements a new attachment for use in a cam-grinding machine has been developed by the Landis Tool Co., Waynesboro, Pa.

The accompanying photographs show the attachment mounted on the Landis 10-inch plain self-contained machine. The camshaft A is driven by dog B, which in turn is driven by driver C, mounted on spindle E and is adjustable to facilitate in setting camshaft in proper relation to master cam. On this spindle is worm wheel F, the spindle being worm driven throughout. On spindle E is master cam G, which is made from solid steel and mounted on spindle by means of taper and nut. In contact with the master cam is roller H, which is moved from cam to cam by means of lever I. The relative position of the roller is indicated by pointer J. By means of a cam on shaft K the roller and master are disengaged by a half turn of lever I and the roller shifted to the next cam by completing the turn. Thus, the roller and master cam are disengaged and roller shifted to proper position by a single movement. On spindle is also placed brake L, its object being to compensate for any lost motion, which would be reflected on cam as the pressure is reversed when passing over the nose.

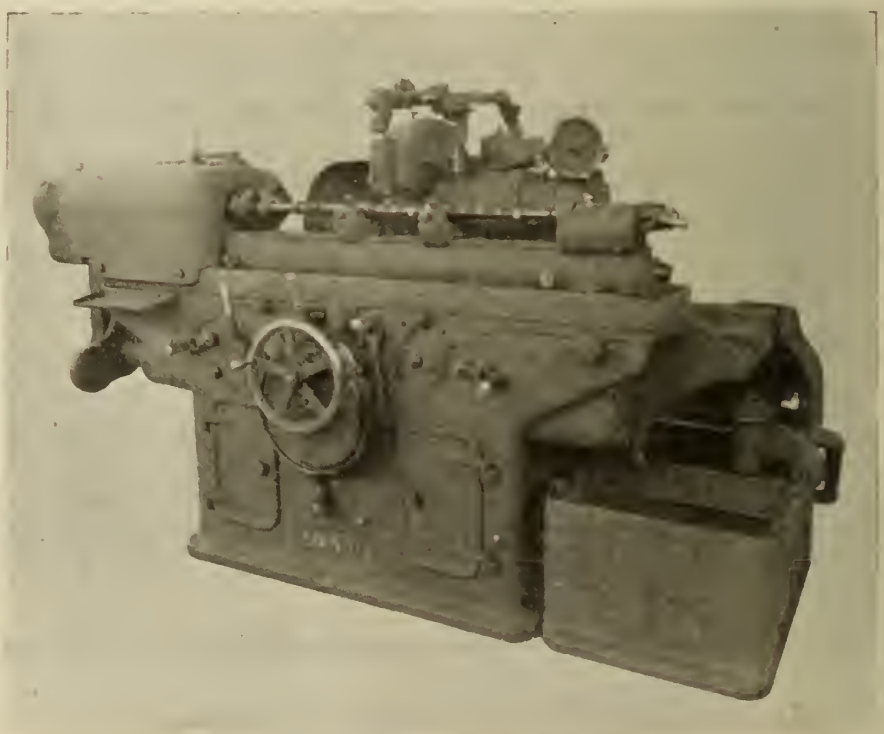
The outstanding features of the new underslung cam grinding attachment as explained by the manufacturer are as follows: The swing bracket is tubular in the cross section and is well supported directly under the master cam and work centres close to the machine bed. This construction balances the swinging bracket, eliminating all strain. The work being carried directly over the fulcrum centre reduces the vertical movement and grinding contact from changing over the periphery of the wheel, thus cutting down to a minimum the difference in contour of cams caused by the changing diameter of the grinding wheel. The



DETAIL VIEW OF THE CAM ATTACHMENT.



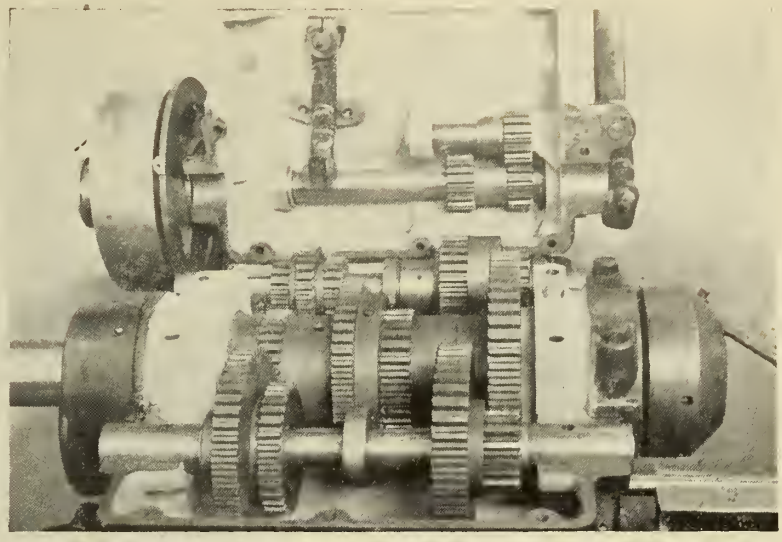
DETAIL OF THE HEADSTOCK.



GENERAL VIEW OF THE GRINDER.

master cam being mounted directly on the headstock spindle, substantially connected and in line with the work, eliminates lost motion and errors. The master cam is kept in contact with the master cam roller by means of compression springs, the tension being adjustable to suit different conditions.

It is pointed out that accurate work is secured when the grinding wheel is of a diameter equal to that of the roller used in contact with the model cam when generating the master. This condition is caused by the contact between the work and grinding wheel travelling above and below the wheel centre. The more the grinding contact varies from the wheel centre, the more pronounced the variation in the contour of the cams ground with different sized wheels. Due to the work being swung an equal distance from a point directly over the fulcrum centre, the movement of the work is practically in a horizontal plane, reducing to a minimum the travel of the grinding contact above and below the wheel centre.



DETAIL VIEW OF GEARED HEAD.

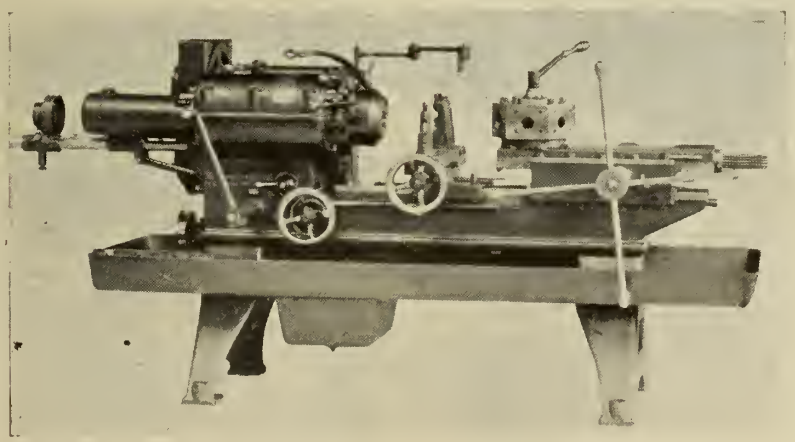
GEARED HEAD TURRET LATHES

The Warner & Swasey Co., Cleveland, Ohio, have placed on the market what is known as their No. 4 and No. 6 geared head construction turret lathes. These lathes have a geared-head construction which is said to deliver four times the power transmitted by the ordinary geared friction head of the same size machine, and twice the power of the double friction back-geared type. Even with this increased power, less effort is required to move the controlling levers; consequently the machine is easier to operate.

The front view of the No. 6 turret lathe with a geared head is illustrated in Fig. 1. The first model of this type built has been thoroughly tested under every condition that might be encountered in service, and six machines of each size have been installed in outside shops for similar experimenting. The results obtained from all these machines have been very satisfactory.

Fig. 2 shows a view of the geared head with the cover removed, from which it will be seen that the steel gears are of a coarse pitch and have wide faces. The gears run in a bath of oil which also lubricates the bearings. Two sets of gears are mounted on the front shaft, while a third set and the reverse friction clutch are mounted on the back shaft. Twelve spindle speeds and a reverse rotation are obtained. Another advantage claimed for machines of the geared-head construction is their adaptability to the various types of motor drive. The head may be geared directly to the motor or driven from it by means of a chain or belt.

The No. 6 turret lathe can be equipped with the standard carriage used on Warner & Swasey turret lathes, one of which is shown on the machine illustrated, or with a heavy-duty carriage that is specially valuable when taking heavy cuts or performing heavy forming operations. A range of six power cross-feeds is provided on this heavy-duty carriage for facing, forming, and cutting off work at various speeds. The No. 4 turret lathe is equipped with a standard carriage. The maximum capacities of this turret lathe are as follows: Diameter of bar stock, 1½ inches; length turned, 10 inches; swing over bed, 16 inches; and swing over cross-slide, 7 inches. The maximum capacities of the No. 6 turret lathe are as follows: Diameter of bar stock, 2¼ inches; length turned, 12 inches; swing over bed, 20⅜ inches; and swing over cross-slide, 9¼ inches.



GENERAL VIEW OF THE TURRET LATHE.

AUTOMATIC MILLING MACHINE

The Potter & Johnston Machine Co., Pawtuckett, R.I., have placed on the market what is known as their No. 1M automatic horizontal milling machine. This machine has been designed in response to a demand for a smaller automatic milling machine built upon similar lines to their present 2-M automatic milling machine.

In designing this machine, two tables have been used, making it a duplex milling machine, a feature which will prove valuable in a great many ways, this arrangement making it possible to handle two distinct classes of work upon the same machine without the operator moving away from the operating position. On the automatic milling machine the operator is loading up the fixture on one side of the table, while the cutter is milling work mounted on the other side, and with the exception of ten seconds required for indexing the table turret and advancing the table automatically to the cutting point there is no lost time, thereby insuring a greatly increased output. As soon as the operator has loaded the fixture on one table he performs a similar operation on the other table, keeping both sides of the machine loaded with work. There are no overhanging arms or projections to interfere with the operator while replacing work in the vise or fixture and all controlling levers are convenient to the operator. There is no waste of power as the machine is practically continuously milling.

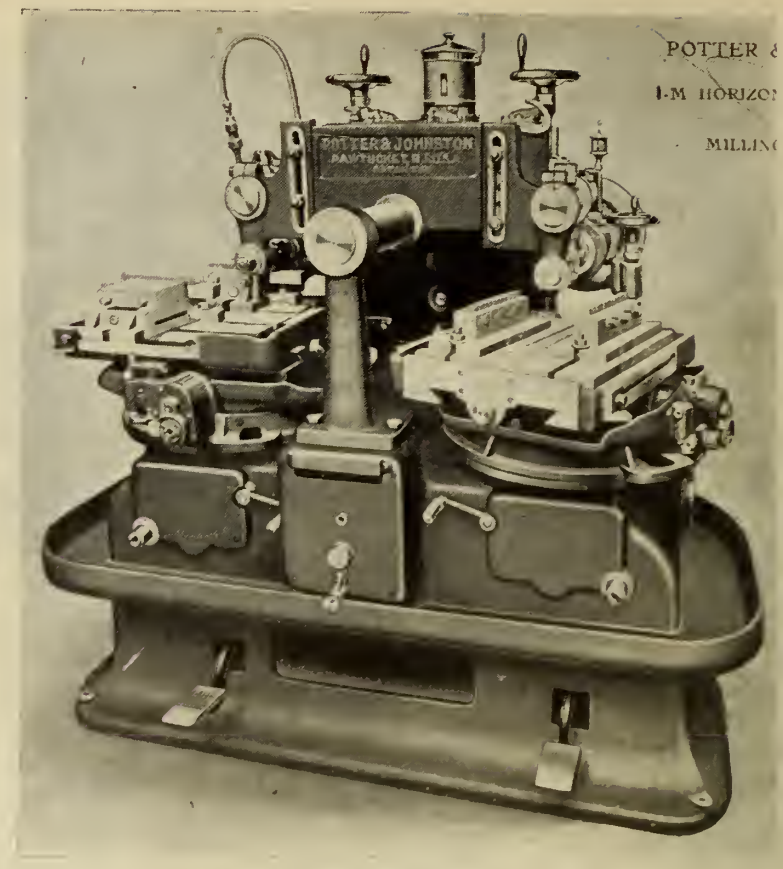
The table base carrying the work tables is at a fixed height, has walls of ample thickness, well braced, and runs to the floor, giving a rigid construction and solid foundation. In this base is the

mechanism for revolving the table turret and feeding.

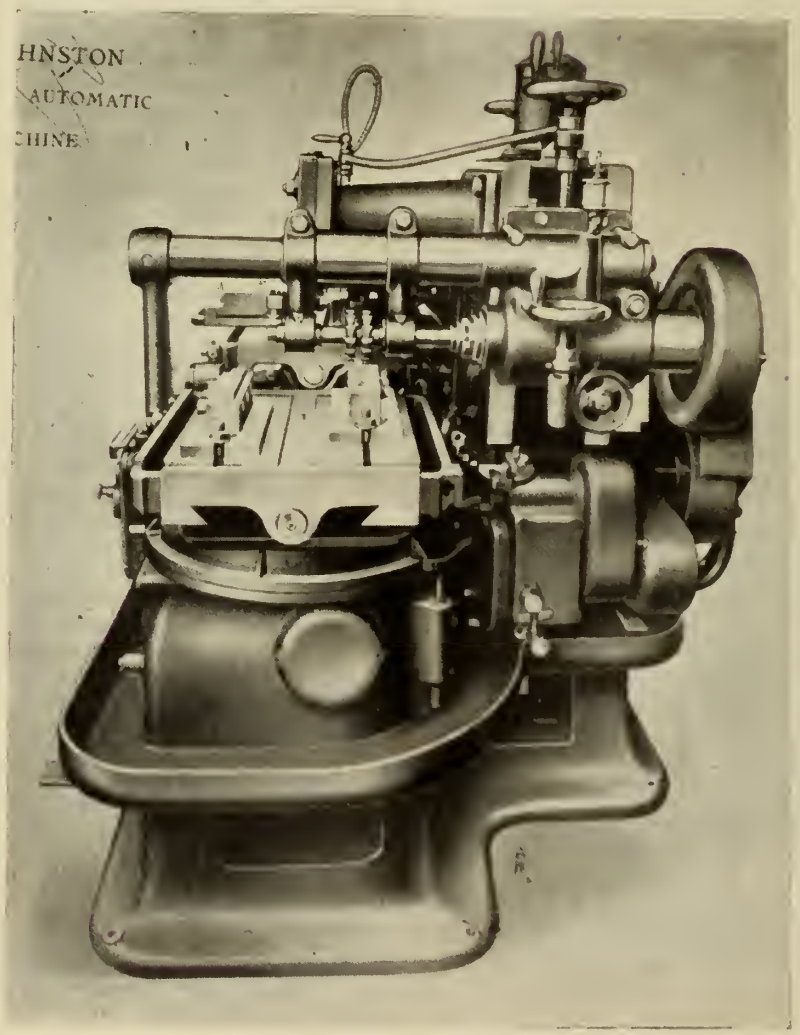
The tables are mounted upon circular saddles or turntables, and the rotation or indexing of these is of the turret principle. Each table has two tee slots, and a wall which runs entirely around the table serves the double purpose of providing a channel for lubricant as well as supporting the vises or fixtures, which are greater than the width of the table, the top of this wall being finished off level with the top of the table. One vise or fixture is carried on each side of the table.

The feeds for each table, which are independent of each other, are accomplished by trains of gears. Sixteen changes of feed are obtainable in practically geometric progression, ranging from 13-16 to 17⅜ inches per minute. With each set of change gears two variations of feed are obtained by changing the hand lever at side of machine to either slow or fast position. The feeds for each table are also independent from the spindle speeds.

Provision is made for operating the tables by hand, also revolving the turret tables when setting up. Automatic stops are provided which are adjustable to suit the different working positions at which tables may be set. When indexing, the tables come to their working positions rapidly and automatically, thus avoiding



THIS VIEW SHOWS BOTH TABLES CLEARLY.



GENERAL VIEW OF THE MILLER.

any hand motion to bring the work up to the cutters. As soon as indexing is completed, the table feed is automatically thrown in. An independent, fast table feed is provided which is a time saver when straddle milling, groove milling, or space milling is being performed, as it brings the work clear of the cutters before the table revolving motion is thrown in.

The revolving and indexing is accomplished by foot pressure on lever at front of machine (each table having its own lever) and the revolving mechanism brings the table turret to the exact position before the lock bolt takes its seating. Ten seconds only are required to revolve and index the table turret, and this is the only period when the cutters are not cutting metal. The design permits of all automatic mechanism being operated by hand.

The spindles are made of crucible steel forging, ground, and running in bearings of phosphor bronze. Compensation of wear is provided in spindle bearings; the front spindle bearing is tapered and the rear spindle bearing straight. The spindle nose is clutched for driving an arbor; the arbor is held in place by a draw-back rod through the spindle, and the spindle is tapered at the front end to receive arbors. The spindle is carried on a vertical adjustable slide, which is in turn carried in a horizontal adjustable sleeve, which is responsible for the traverse of spindle. The adjustment for both spindles is independent. Graduated dials facilitate the settings.

The spindle drive is actuated by means

(Continued on Page 64.)

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The Price of Machine Tools

THE automobile situation must give an effective answer to the idea that cut prices will bring about a worthwhile buying movement.

When the first cuts were announced, there was some buying in almost immediate response to the move, but, upon analysis, it was found to be almost entirely dealer trade.

When these orders were filled the movement was largely stopped, as there was no buying on the part of the ultimate consumer.

And that is where the business in cars stands to-day. The cut has apparently been made in vain.

Machine tool men will bear this out. Reductions have been made in some cases, but is there evidence that it has brought in a corresponding amount of new business?

The feeling at the National Machine Tool Builders' Association was against reduction, claiming that no good would result. Against that was the minority report, expressed at the Dealers' Convention, "Prices must be made lower on machine tools, for the buying expects it. I think that a general reduction is almost essential."

The trouble with all conventions is that they bring together men with the same mind, leaving aside for the time being the men to whom they look for the bread and butter of the business, viz., the buying public.

The buying public can be conveniently ignored at conventions, but they must be reckoned with when the dealers get out to put into actual operation the extra steam generated at conventions.

The dear general public may demand lower prices in machine tools, but the thing the dealers and makers would like to know is—would they come along and buy simply on the strength of a price reduction?

The Joy of Accomplishment

MR. J. H. BAIRD, founder of the Baird Machine Co., of Bridgeport, Conn., has died at the ripe old age of 93 years, and his passing will be regretted by lovers of machines and inventions.

Mr. Baird will not live as a great business man, although he was wise enough to surround himself with good business executives. He will be remembered and loved for his own words, "Well, I don't care if I did lose money, I made the dern thing work." That is the frame of mind that extracts pure, unadulterated pleasure out of accomplishment. He would take more out of gaining his point in mechanics than out of making a million in cash.

It was this feeling that made Mr. Baird the success he was as an inventive genius. Were he alive to-day he would probably object to the term "genius," but he would have to admit that at least it was the reward of patience. He made pins. He did away with the idea that "it takes ten men to make a pin." He made pins and made machines that put them in the papers—and after that he made another machine that made safety pins.

Many of his inventions bore out the fact that an inventor is often a poor business man. For instance, years ago Mr. Baird made a machine that fastened the hoops in hoop skirts. This he sold for $30, whereas the man who purchased it made a resale for $50,000, which was almost a fabulous sum in those days.

And there is nothing on record to show the regret of the inventor. His name will live as the inventor of that machine, whereas the man who made the $50,000 out of selling it has been forgotten long ago.

The inventor put something real and lasting into the world—the man who made himself rich over a short handling did not.

Mr. Baird was a relic of the old school, where accomplishment was counted greater than reward, where, in fact, accomplishment was its own reward.

And after all is said and done, it's a pretty fair record to leave in these money-mad days:—"Well, I don't care if I did lose money—I made the dern thing work."

A profit-sharing scheme is a popular thing when there are profits.. A plan that will hold interest in the lean days is more to the point.

German engineers are working to secure a substitute for coal, the idea being to draw electricity direct from the atmosphere. The idea is well within the range of possibility that in years to come our present expensive power plants will be scrapped, and mechanics and engineers of years to come will regard them as we do the tread mills of past generations.

What the Business Papers Say

Paying on Basis of Results

Engineering, London.—"When we turn to the question of the acceptance of payment by results by the unions as a whole we are again obviously at once confronted with difficulties. In this case, however, we think the opposition would come more from certain unions officially than from the individual work people. This should make the matter more easy to deal with. Various systems of payment by results are, of course, in operation in many trades, and in general are certainly favored by the people who work under them. In other trades the system is forbidden, but we know of more than one case in which such a system is being worked to in certain shops with the full concurrence, and even at the desire, of the work-people in defiance of union rules. A general acceptance of payment by results is not going to be granted off-hand, but the bringing about of such an acceptance is a sufficient possibility to make the matter well worth bringing forward in a definite way."

Where Prices Really Stand

British Trade Review.—Common talk on this question of price-reductions has been often misleading. To a large extent recent downward movements are due to abstinence from buying, and it is quite clear that this holding off on the part of purchasers cannot go on indefinitely. Since present quotations in some cases represent the minimum of profit, or even a loss, to the seller, it is clear that the position is to some extent artificial, and it would seem to follow that when buying is resumed prices will harden in the classes referred to. The world is still hungry for goods, and when activity is resumed in the markets it is more than probable that buying will be conducted on a large scale. Under the circumstances the question arises whether the present would not be a suitable time for buyers to consider the advisability of recommencing operations.



MARKET DEVELOPMENTS



The Markets Afford an Interesting Study

Many Sides Are Shown This Week—U.S. Steel Prices May Come Down Below Corporation Levels—New York the Scene of Gatherings of Dealers and Makers, But No Price Announcement Results.

THE conventions of both makers and dealers in machine tools have come and gone, but so far they have not been followed by any announcement regarding reduced selling prices. At both of these meetings the point was made a good many times that present costs are very high and not out of line with the selling prices. Cancellations were also spoken of, and it was found that conditions in United States in this particular are probably worse than in the Canadian field, as the number of cancellations here has been comparatively small in all lines of machine tools.

Iron and steel warehouses are doing a fair trade, and prices remain about the same. This week sheets dropped back a little, as there are quite a number of re-sales in the market, coming from manufacturers who find that they are rather heavily stocked with high-cost material and prefer to get rid of some with the idea of stocking up later on at a better figure. There is a good demand for most lines of sheets though, and the surplus stock is not going to influence the market very much one way or the other.

Boiler tubes are in demand, many of the boats being tied up now ready for the season's repairs.

The automobile shops are not in any better condition than they have been for some time back. The reductions announced in the price of cars were taken up by dealers who placed orders for next season. When these were taken care of the buying ceased, and orders are badly needed in nearly every car shop in the country.

The scrap metal market can stand almost any phrase that one cares to apply to it this week, and the more strenuous the phrase the more pleasing to the dealers. Some of the yards must be having a hard time in making ends meet with the amount of trade that is in sight, and there is nothing in particular that would encourage the belief that things are going to get better. The steel mills are not buying, neither are the foundries, while offerings for non-ferrous metals do not exist.

MATERIAL COMES VERY QUICKLY FROM THE STEEL MILLS NOW

Special to CANADIAN MACHINERY.

MONTREAL, Que., Nov. 25.—The steel market today reflects the conditions that exist in almost every phase of industrial life. Doubtless, the seasonable quietness is responsible for much of the dullness, but other factors are influencing the apparent depression that is becoming more pronounced every day. The tendency to lower prices on steel commodities is more or less marked in every direction, but nothing drastic has yet been done in the price-cutting movement. Operations at the mills are becoming more restricted and production is fast becoming a problem. It is easy to get the output but the mills are reluctant to produce steel far beyond the immediate requirements of the trade, and these demands are below normal, and at the same time very irregular.

The cry of delayed delivery on many classes of steel is now a thing of the past, and if heard at all, is a feature of transportation rather than production. This might be exemplified in the statement made here by a dealer. "Just recently," he remarked, "we mailed an order to our American mill for some material that had to be rolled to special dimensions. At the beginning of the following week we were requested, by the consumer, to make some slight changes in the sizes previously stated. We immediately wired to the mill, only to be advised that the material had been rolled and was ready for shipment. This, while being a specific case, is nevertheless true of the general market." In commenting on the decline of price quotations the dealers could not say how far this would extend but could not see where any great reduction could be made in the face of existing cost of labor and materials. Raw materials, of course, were becoming more reasonable in price, but production costs per ton showed little decrease. There is, however, a feeling that general adjustment of wages may follow the movement in this direction by individual firms. Canadian mills are showing the trend of the times, as reports indicate a decline in the volume of business on the books. One local dealer stated that the general quotation in Pittsburgh for tank plates was $3, and that even lower prices had been reported. The price here, from warehouse, was on the base of $6 for ¼-inch and up, and $6.50 for 3-16 inch plates. Demand in this regard shows a marked falling off. While some mention has been made of an easier situation in boiler tubes, the needs of the trade for this commodity is still ample to maintain the present strength of the prices quoted. The easier market in sheets shows the effect of the inactivity in the auto industry, and the prices reflect the volume of the supply over that of the demand. Quotations here are on a basis of $9.25 for No. 28 gauge black and $7.75 for blue annealed No. 10.

Inquiries Still Come In

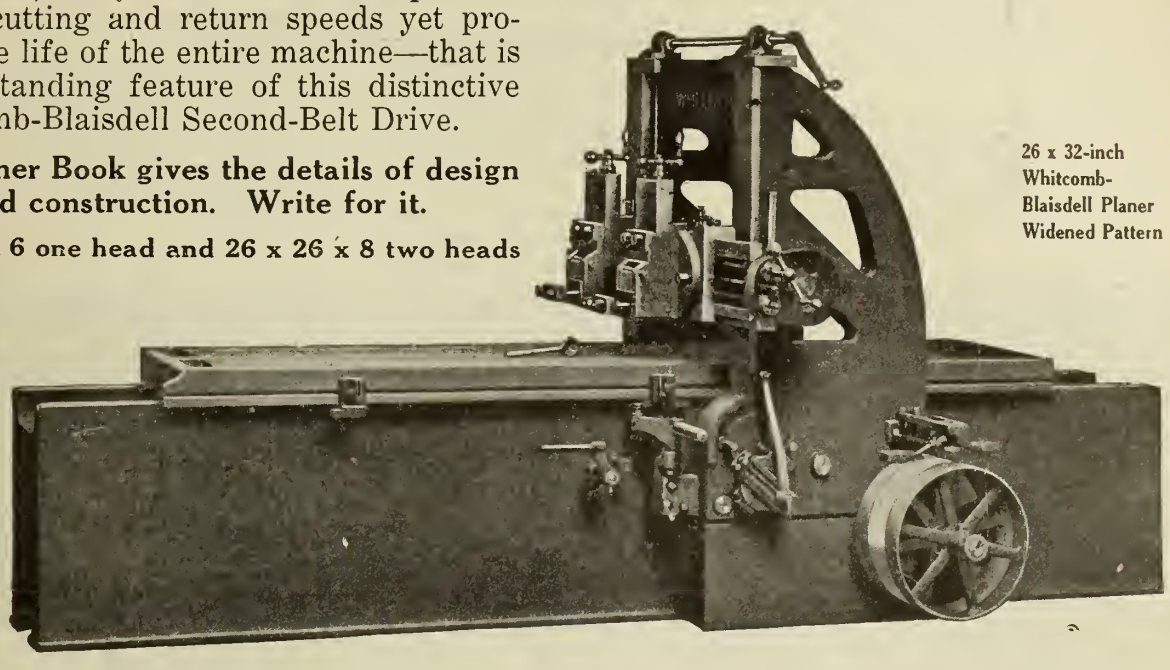
"It is only the man who is definitely persuaded that he needs a tool who is in the market at the present time." This statement seems to reflect the condition generally prevailing in machine tool circles. Some dealers report a good week, but the sales in the aggregate are below normal. While admitting a falling off in heavy machine tools sales, nearly every dealer agrees that the trade is in need of equipment and that the slackness now evident is more than a seasonable one. The consuming trade in ma-

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chine tools is no different than in other lines where people are influenced by the lowering trend of prices. When the market was in the ascendant the cry of replacement values held the attention of all, particularly of the consumer, and this is one factor of present trading that is responsible for much of the business let-up. One is encouraged, however, at the optimistic tone of some dealers' remarks, and the turn of the year is expected to open the way for a renewal of more active trading. In speaking to Canadian Machinery one dealer stated that during the past month he had received many inquiries for different lines of equipment, and while realizing that the great majority of these were nothing but price feelers, he felt it his duty to answer such inquiries, but in most cases nothing further developed.

Coppers and Tin Down

Metals, like other commodities, are absorbing some of the dullness that is prevalent throughout the country. Sales are quieter than for many months, partly due to seasonable decline and partly to the general retrenching policy of many lines of industry. Few deny the normal requirements of the trade, but until the country as a whole becomes a free buyer the metal situation will experience a quiet period. Coppers have again declined locally to the extent of 1 cent per pound. Lake is quoted at 20 cents, electrolytic at 19½ cents and castings at 19 cents per pound. Tin is affected by the decline on the English market and shows a drop of 4 cents per pound. The quotation here is 48 cents per pound.

Dullness Very Pronounced

"Still in the same position," remarked a dealer in old materials. "Waiting for something to turn up and convert the dullness into cash. There is practically no market and prices are little guide to the situation. Quotations are necessary, I suppose, and those given are as good as any other." When asked as to what prices would actually be paid, the dealer stated that it would all depend on the nature of the sale, and with sales of a negative character, the prices were of little consequence. The scrap movement here is very light and irregular.

NOT MUCH CHANGE IN THIS MARKET

Prices For the Most Part Are Holding Firm—Scrap Market Remains Inactive

TORONTO.—There are several lines of business in this district that could, just now, report trading almost the same from week to week. There are a few firms with high spots, there are a few with the very low spots, while most of them are in between. For the most part dealers recognize that they are going through a period where their business acumen is going to be taxed, but they have looked forward to this period coming for a long time back. Generally they are prepared to stand it, although in some cases credit and finance are receiving a great deal more attention than ever before.

The local machine-tool dealers do not see much in the proceedings of the National Machine Tool Builders' Association to justify the belief that there will be a cut in the prices soon. One of the salesmen from a large American firm, who spent some time in the district this week, stated that their price reduction had been made several weeks ago and they were selling now about 50 per cent. of their capacity. He was certain that, as far as his company was concerned, it would not be possible to make any more price reductions for many months to come.

The matter of price is also referred to at some length in another section of the markets, in reports from the convention at New York where these matters were freely discussed.

There are a number of inquiries coming into the market here, but the majority of them are for single machines, and many of these inquiries are not yet turned into real sales. Machines on order are coming in rapidly as a general thing, and the delivery schedules are getting pretty well worked out.

Small Tools Market

There is a real honest-to-goodness

selling going on in the small tool market. There are no large orders. The purchasing agents in this district are getting so used to seeing a number of the salesmen from the small tool houses or branches that they must be at the point where they can call most of them by their first name.

The National Railways are inquiring for quotations on an assortment of high-speed drills, but the business has not been placed yet. The prices, recently revised, are standing and are likely to for some time.

The Steel Market

There is still a fair amount of business in the steel market. In some cases there are lines that are moving well. There has been a marking down in the warehouse prices of black sheets and of blue annealed. The base price of 28's is now given as $9.50, and blue annealed at $8.50; galvanized 28 are still $12, and 10¾ are $12.40, although the galvanized prices are weak at this point, and a reduction is quite possible.

There is considerable reselling going on in sheets now. Manufacturers find they have lots on hand that are not needed just now, and they figure it would be good business to clear out their high-priced stock if they have the chance to do it. Against this there is the fact of a good demand for sheets, and the chances are that this surplus stock will be taken up shortly, and when this is done the market will have to face the ordinary conditions. It is possible to secure sheets at present on fairly short notice. For the most part the available stock is from the independent mills and fairly high in price. Corporation deliveries are expected by several of the dealers as they have been on the books for as long as twelve months. In view of the fact that they are likely to be getting this material they are not booking with the independents.

Tubes are in fairly good assortments in several of the local warehouses, and they are moving out well. The demand at this time of the year is from lake boats that are now tied up for the season and are undergoing necessary repairs. This makes a call for the larger sizes, 3½ and 4 inch, while the demand for tubes for industrial plants has not fallen off to any degree, as might be expected owing to the lateness of the season.

Bar iron is selling in fair quantities. This is hardly the season when one looks for a big movement in this.

Structural men figure that there is a lot of tonnage ahead of them in connection with a number of the larger buildings that are planned for this city and the surrounding district.

Pig iron prices vary according to tonnage taken and other terms of contract. A man who knows the situation pretty well sized up the situation this week as follows: No. 1 foundry iron, of 2.50 to 2.75 per cent. silicon is selling around $59 delivered in Toronto now, while No. 2 iron or 1.75 to 2.25 per cent. silicon would be about a $1 a ton under that figure.

Several U. S. brokers who have quite ample tonnages at their disposal have been going through Canada offering attractive figures on resale iron. Apart from brokers there are a couple of U.S. firms making a special effort to break into the Canadian market. Of course there is the duty of $2.75 per ton, exchange at current rates, which are a little higher than usual just now, and the carrying charges.

There is very little pig iron being purchased by the Canadian trade at the minute. A number of inquiries that come into the market are for purposes of estimating on contemplated work, and for the purpose of comparison.

A well-known maker of iron stated to Canadian Machinery that Canadian furnace costs were as high to-day as they were several months ago, and there were not many indications of reductions being in sight. However, he admitted that if it were found necessary there might be a readjustment in their selling schedule, although he still held that the law of costs and selling price did not warrant such a move.

The scrap market has been referred to as dull, dead, inactive, stagnant and everything else that gives the idea of no business being done.

Well, one might take any one of these new phrases now and apply it with perfect safety to the scrap metal trade. The export market is not lending any strength to the situation, as the outside markets are apparently facing much the same situation as the markets here. The steel consumers, if they are in the market, are offering prices that the dealers would not consider. Neither are the foundries doing anything better, nor has wrought iron scrap been asked for. Buyers of non-ferrous have not done much better in the way of taking anything out of the scrap heap. Small lots have been wanted, otherwise there is no movement. Some of the dealers are of the opinion that the list, quoted elsewhere, which is low enough, should be regarded as purely nominal, and it may be battered down even more, although no dealer had the heart this week to knock any of the figures down lower.

POINTS IN WEEK'S MARKETING NOTES

Pittsburgh says that production of steel is decreasing rapidly and that many of the independent mills are now not operating at 60 per cent. of their capacity.

—

It is rumored that the decrease in prices of steel, finished and semi-finished, may go below the Steel Corporation schedule.

—

Merchant blast furnaces have in many cases gone out of business. For a good many months users have been buying in very small quantities, and it has caused no surprise to find that some of the stacks are out of orders.

—

Machine tool dealers do not find much in the reports of the National Tool Builders' Association to cause them to believe that there will be a reduction in prices.

—

The National Railways are inquiring about high-speed drills, but so far no business has been placed.

—

There is a fair amount of business in the steel warehouses, especially in sheets and boiler tubes, the latter being called for at this time of year by boats that are now laid off for season's repairs.

—

Blast furnace men in Canada report that purchases of pig iron are being made in very small quantities.

—

The scrap metal market shows no signs of improvement in any line. Steel mills are not taking on anything at present and the foundries are not doing much better. Even the present very low price in scrap metal may have to give way to still lower levels before business is done on a larger scale.

BIG STEEL PLANT SHUTS OFF QUICK

In Response to Demands That Claims of Railroad Men Be Met At Once

Sydney.—When 125 railroad employees of the Dominion Steel Corporation served an ultimatum on the management demanding a settlement of their wage differences before five o'clock the same day the company replied by closing down the various mills at noon and ordering the banking of the blast furnaces. This action automatically threw 4,000 men out of employment, pending the settlement of the dispute with the railroaders. It is estimated that it will require at least a week to get the furnaces in operation again, and it is believed that the big plant will be tied up for that period at least. The company, in the meantime, it is understood, is making application to Ottawa for redress under the provisions of the Industrial Disputes Act. It has been stated that lack of orders has been threatening the operations of steel plants for some weeks past. For the past two years the railroaders employed within the steel plant have been contending for the scale awarded all other railroaders in Canada following the McAdoo award in the United States.

THE WORLD CALLS

NEVER BEFORE, AS NOW, HAS THE WHOLE WORLD CALLED

"PRODUCTION"

Are you doing any Screw Thread Cutting?

How are you doing it?

Do you know that Geometric Thread Cutting Tools have effected an enormous saving of time and costs in many thousand shops?

The first step is to investigate. Tell us the job you have to do, and hear what we can do for you.



THE FINAL SHIPMENT OF THE DAY---*THE FREIGHT SHIPMENT*

Express -- Parcel Post -- Auto Truck -- Freight

These are the four channels by which Geometric Screw Thread Cutting Tools and Machines are shipped.

There is no place where more business is done to the square foot than in our Shipping Department, because of the demand for Production Tools—Automatic Die Heads and Collapsing Taps—everything for more and better screw threads.

Make Screw Thread Cutting the Most Satisfactory Operation in Your Shop.

——Write——

THE GEOMETRIC TOOL COMPANY

NEW HAVEN CONNECTICUT

Canadian Agents:

Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg, St. John, N.B., Halifax, N.S.

Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

If interested tear out this page and place with letters to be answered.

PRICES NOT LIKELY TO STOP AT STEEL CORPORATION LIMIT

Special to CANADIAN MACHINERY.

PITTSBURGH, November 24.—The pig iron and steel markets continue stagnant as regards new buying, while there is a further decline in specifications against contracts and a fresh wave of cancellations and postponements. Production, accordingly, is decreasing, and at a more rapid rate than formerly.

There is, in fact, a very sudden ending to the spell of steel scarcity, with heavy pressure upon mills for deliveries. It is by no means remarkable that the change should be sudden, the remarkable thing being that the pressure continued so long after various other industries had become quiet. The end of the period of feverish activity and the decline in inflation was foreseen long ago, even early in the year, when not a few observers were predicting a panic by August, and the Federal Reserve Board undertook to bring about a gradual deflation so as to prevent a smash. The steel industry maintained its activity longer than might have been expected, and naturally when the end came it came suddenly.

Prospective Prices

In the past two or three weeks the opinion has been spreading rapidly that before this readjustment in the iron and steel industry is completed there will have been declines in the Steel Corporation prices. Until recently, the common, almost universal, prediction was that the steel market would find its level, in the readjustment, by the independent prices dropping to the Steel Corporation level and staying there, the whole market being thus equalized and stabilized, with a fresh buying movement beginning. Many observers predicted that the operation would be completed by March or April. It is strange that the prediction gained such popularity, for it was essentially an unsound one. There was a time when, if the independents had voluntarily reduced their prices to the Steel Corporation or Industrial Board level, buyers would have had confidence in the prices thus made, but the opportunity is past. The order books of some independents are almost exhausted, yet they continue to quote their higher prices. Buyers see that the law of supply and demand is being disregarded by producers and are indisposed to have confidence in any prices quoted. When independents reduce their prices it will be only because they are forced to do so and when the Steel Corporation level is reached the independents naturally will not stop there, as there is no business waiting to be placed at that particular level.

The common prediction now, therefore, is that the independents will eventually go below the Steel Corporation prices. It is seen that the readjustment in business and financial conditions generally, in the direction of prewar prices, is going to go farther than was expected a few months ago would be the case. Production costs, therefore, will come down, and with a decline in costs selling prices for steel below the present Steel Corporation prices are to be expected.

Chairman Gary of the Steel Corporation late last week made a carefully worded public statement. The substance was that the corporation has had good grounds for advancing its prices above the Industrial Board schedule of March 21, 1919, for several reasons, including in particular the wage advances and the freight rate advances, but has refrained from doing so, and that it has been decided to continue present prices "unless and until it becomes necessary and proper to make changes to meet altered conditions." The iron and steel trade has experienced no difficulty in concluding that the qualification means that prices eventually will probably be reduced. As prices have not been advanced when costs increased, and costs are certain to decrease rather than increase in future, no other conclusion is logical. It is inferred that the corporation will have little disposition to reduce its prices in the near future on account of such shading of its prices as the independents will probably be indulging in within a short time, say within two months at the most. The corporation will then still be moderately well supplied with orders while the independents will have practically nothing left, and the corporation would hardly dispute the right of the independents to get some business, even though the independents have made such large profits of late that they could afford to be idle a half year or longer and still have greater profits in the aggregate than the Steel Corporation.

Production

Many of the independents, representing perhaps half the total independent capacity, are operating at 60 per cent. or less, this representing a sudden decrease. One large independent has been making scarcely any steel at all, while operating its finishing departments in a moderate way, working up accumulations of semi-finished steel. Very few independents are operating within 90 per cent. of their rate in August or September. The Steel Corporation's operations are well maintained, and with a possible exception here and there the corporation plants are producing larger tonnages than at any time since last March. However, it looks as though even the corporation would have to decrease operations soon at some of its plants, though probably only to a small extent.

As to the merchant blast furnaces, they have almost run out of business, and this is only what was to be expected, since for more than six months consumers have been buying very sparingly, only for early deliveries and then in as small tonnages as possible There is no demand in the market now, irrespective of price, and as furnaces would not think of piling iron when costs are on the eve of a great readjustment the only course is to blow out as soon as orders run out. While a furnace will not make up stocks for future sale, it will before blowing out produce enough iron to take care of deliveries that its customers are certain to take in the near future.

Iron and Coke Prices

Since last report market quotations on pig iron are down $2 a ton as to Bessemer and $1 on both foundry and basic. The declines occurred on extremely limited transactions, and the next business that develops will in all probability see further declines. The market just now is quotable at $40 for Bessemer, $39 for foundry and $37.50 for basic, f. o. b. valley furnaces, freight to Pittsburgh being $1.96.

Before buyers of pig iron and steel products take hold again with any freedom prices will be much lower, and the buyer will have much to say as to price. Profits will have to be telescoped. The pig iron buyer will not take hold in pig iron on the basis that the furnaceman is making no profit if he is paying a big profit to the coke maker. The coke maker must do his share. Thus far the coke maker has not seen the light. Connellsville furnace coke for spot shipment is $8 to $8.50, when $5 would afford a very good profit. As to Lake Superior iron ore, prices for which for the 1921 season will hardly be set before April or May of next year, little if any reduction is to be expected, as ore prices have been moderate right along. There may be a slight concession by the ore producers just to show their willingness to co-operate, and if there is any decline in the lake rate, which in the past season was $1.20, including the unloading charge at Lake Erie docks, that will be handed on to the ore buyer.

Street Railway Steel.—A number of conferences have been taking place during the past week between Toronto civic representatives and engineers and officials of the United States Steel Corporation. The whole matter rests with the proposed changes and extensions to the street railway system in Toronto, to be undertaken after the city takes over the road. The city is anxious to secure information as to the best way to make the change in track and possibly gauge, and at the same time keep the service in operation, and the experience of the U. S. Steel Corporation engineers was desired in this connection.

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METAL CUTTING SAWS



Solve your Metal Cutting problems, easily, quickly and economically, by adopting the products made by

ATKINS

We make Kwik-Kut Power Hack Saw Machines which use practically the full cutting edge of the Hack Saw Blade at each stroke; Metal Cutting Band Saw Machines for general shop work, cutting all classes of metal up to 12 x 14 inches.

Your requirements for Metal Cutting Circular Saws can be supplied promptly and we solicit a trial of our "AAA" Non-Breakable and Power Hack Saw Blades and Frames.

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E. C. Atkins & Co.

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"The Sterling Quality Saw People"

Factory: HAMILTON, ONT. *Branch:* VANCOUVER, B.C.

If interested tear out this page and place with letters to b answered.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$39 96
Lake Superior, charcoal, Chicago	53 50
Standard low phos., Philadelphia	44 79
Bessemer, Pittsburgh	41 96
Basic, Valley furnace	37 50
Toronto price:—	
Silicon, 2.25% to 2.75%	57 50
No. 2 Foundry, 1.75 to 2.25%	56 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 75
Steel bars, base, Montreal	5 75
Reinforcing bars, base	5 50
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	8 50
Chequered floor plate, ¼ in.	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	3 50
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	5 50
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 67 to 5 50
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58½	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

METALS

	Gross. Montreal	Toronto
Lake copper	$20 00	$20 50
Electric copper	19 50	20 50
Castings, copper	19 00	20 50
Tin	48 00	50 00
Spelter	9 00	10 00
Lead	8 25	9 00
Antimony	8 50	9 00
Aluminum	36 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 6 50	$ 7 00
Plates, ¼ up	6 00	6 60

PIPE—WROUGHT

Standard Buttweld Pipe

Per 100 Ft.

	Steel Blk.	Steel Galv.	Gen. Wrought Iron Blk.	Gen. Wrought Iron Galv.
⅛	$ 6 50	$ 8 50	$.....	$.....
¼	5 31	7 41	5 91	8 01
⅜	5 31	7 41	5 91	8 01
½	7 10	8 63	7 95	9 48
¾	8 80	10 87	9 95	12 02
1	13 01	16 07	14 71	17 77
1¼	17 60	21 74	19 90	24 04
1½	21 04	25 99	23 79	28 74
2	28 31	34 97	32 01	38 67
2½	44 75	55 28	....	....
3	58 52	72 29	....	....
3½	74 06	90 62	....	....
4	87 75	107 37	....	....

Standard Lapweld Pipe

Per 100 Ft.

	Steel Blk.	Steel Galv.	Gen. Wrought Iron Blk.	Gen. Wrought Iron Galv.
2	$32 01	$ 38 67	$35 71	$42 37
2½	48 26	58 79	54 11	64 64
3	63 11	76 88	70 76	84 53
3½	75 90	92 46	85 10	101 66
4	89 93	107 55	100 83	120 45
4½	1 05	1 29	1 30	1 54
5	1 22	1 50	1 52	1 80
6	1 58	1 95	1 97	2 33
7	2 06	2 53	2 53	3 01
8L	2 16	2 66	2 66	3 16
8	2 49	3 07	3 07	3 64
9	2 98	3 67	3 67	4 36
10L	2 77	3 41	3 41	4 05
10	3 56	4 39	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger, 50%.
4" and under, running thread, 30%.
Standard couplings, 4-in. and under, 30%.
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$10 50	$10 50
Copper, crucible	13 00	12 00
Copper, heavy	12 50	12 00
Copper wire	12 50	12 00
No. 1 machine composition	13 00	12 00
New brass cuttings	7 00	9 00
Red brass turnings	10 00	10 00
Yellow brass turnings	7 00	7 50
Light brass	5 00	5 00
Medium brass	6 50	6 00
Scrap zinc	5 00	5 50
Heavy lead	5 25	5 60
Tea lead	2 50	3 00
Aluminum	16 00	16 00

	Per Ton	Gross
Boiler plate	13 00	12 00
Malleable scrap	20 00	23 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	23 00	25 00
No. 1 machine cast iron	32 00	33 00
Pipe, wrought	9 00	10 00
Car wheel	30 00	33 00
Steel axles	20 00	20 00
Mach. shop turnings	8 00	9 00
Stove plate	25 00	25 00
Cast boring	8 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	+10
Carriage bolts, ⅜-in. and less	Net
Coach and lag screws	—15
Stove bolts	55
Wrought washers	—25
Elevator bolts	+10
Machine bolts, 7-16 and over	+10
Machine bolts, ⅜-in. and less	+10
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net

Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 50
Nuts, hex., tapped	add 3 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws —20% 25 and	5
Sq. and hex. hd. cap screws	12½
Rd. and fil. hd. cap screws	plus 25
Flat but. hd. cap screws	plus 50
Fin. and semi-fin. nuts up to 1-in.	12½
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	—5
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	+12½
Studs	+5
Taper pins	—12½
Coupling bolts	+40
Planer head bolts, without fillet, list	+45
Planer head bolts, with fillet, list plus 10 and	+55
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	+60
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add +85
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails, base	$6 10
Cut nails, base	7 00
Miscellaneous wire nails	50%

ROPE AND PACKINGS

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

GRATON & KNIGHT

Announces

SWEEPING PRICE REDUCTIONS

The Result of Months of Concentrated Effort

FOR several decades the Graton & Knight Manufacturing Company has been the leader in the leather belting industry, taking the initiative in every important change. In keeping with this position, we announce a general price reduction on all grades of leather belting.

Only by taking advantage of every economy in manufacturing and marketing made possible by the tremendous volume of our business are we now able to offer to the public this substantial reduction in price and still maintain our high standard of quality.

This reduction became effective November 18, 1920.

The manager at our home office, 356 Franklin St., Worcester, or any of our branches, will give particulars upon request.

W. M. SPAULDING, President

THE CANADIAN GRATON & KNIGHT, LIMITED
84 St. Antoine St., Montreal, Canada
Oak Leather Tanners, Makers of Leather Belting and Leather Products
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Graton & Knight
Standardized Series
Leather Belting
Tanned by us for belting use

If interested tear out this page and place with letters to be answered.

MISCELLANEOUS

Solder, strictly	$ 29½
Solder, guaranteed	0 31½
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	20 35
Red dry lead, 100-lb. kegs, per cwt.	16 00
Gasoline, per gal., bulk	0 42
Pure turp., single bbls., gal.	3 15
Linseed oil, raw, single bbls.	2 37
Linseed oil, boiled, single bbls.	2 40
Wood alcohol, per gal.	4 00
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S.S. drills, wire size	35
Can. carbon cutters, plus	10
Standard drills, all sizes	35
3-fluted drills, plus	10
Jobbers' and letter sizes	35
Bit stock	40
Ratchet drills	10
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers, carbon	50
Centre reamers	5
Chucking reamers	net
Hand reamers	10
High speed drills, list net to plus	20
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	70	85
Class B	30	40
Class C	20	30

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 9 25	$ 9 50
Sheets, blue ann., No. 10	7 75	8 50
Canada plates, dull, 52 sheets	13 00	13 00
Can. plates, all bright	14 00	.....
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	13 50	.....
Fleur-de-Lis, 28 B.W.G.	13 00	.....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	12 00
Premier, 10¾-oz.	11 50	12 40
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	35 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	..
Royalite, per gal., bulk	29½
Palacine	32½
Machine oil, per gal.	65
Black oil, per gal.	34
Cylinder oil, Capital	1.01
Petroleum fuel oil, bbls., net	19

BELTING—No 1 OAK TANNED

Extra heavy, single and double	6½
Standard	6½
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic. 50 ft.	$2 00
Lufkin Metallic. 603. 50 ft.	2 00
Admiral Steel Tape. 50 ft.	2 75
Admiral Steel Tape. 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape. 50 ft.	2 75
Rival Steel Tape. 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels. bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	.24
Peerless	.22½
Grand	.22½
Superior	.22½
X L C R	.21
Atlas	.20
X Empire	.19½
Ideal	.19
X Press	.17½

Colored

Lion	.17
Standard	.15
No. 1	.15
Popular	.13
Keen	.11

Wool Packing

Arrow	.35
Axle	.28
Anvil	.22
Anchor	.17

Washed Wipers

Select White	.20
Mixed colored	.10
Dark colored	.09

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades ... 15%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$37 50	$37 00
Copper wire, list plus 10	..	
Plain sheets, 14 oz., 14x60 in.	44 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	47 00	46 00
Copper sheet, planished, 16 oz. base	51 00	50 00
Braziers', in sheets, 6 x 4 base	43 00	42 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$11 50	$14 50
Sheets, 3½ lbs. sq. ft.	11 25	14 00
Sheets, 4 to 6 lbs. sq. ft.	11 00	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

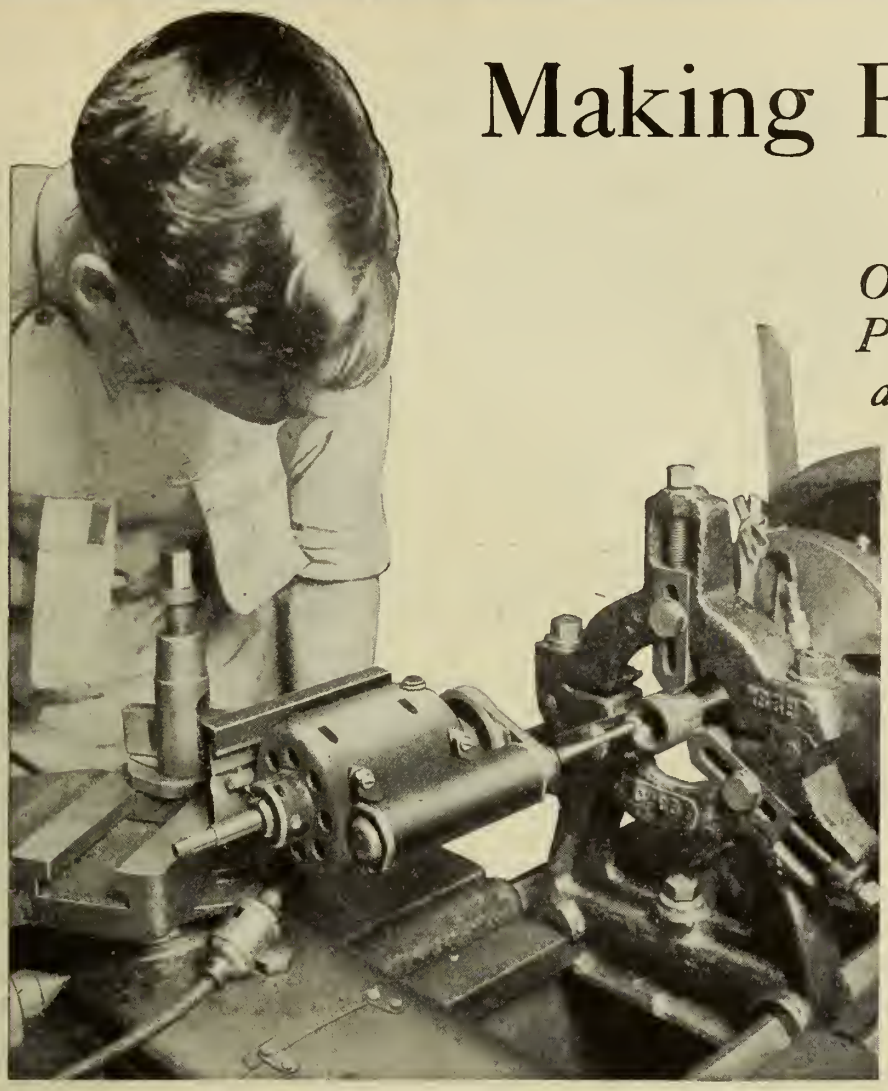
PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.04¾
Acid, nitric	.11
Acid, sulphuric	.04½
Ammonia, aqua	.15¾
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.16
Copper, carbonate, annhy	.41
Copper, sulphate	.13
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.20
Nickel carbonate	.32
Nickel sulphate	.20
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lbs	9.00
Sodium phosphate	.15
Tin chloride	.30
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated

Making Fine Tools

An Interesting Operation, Economically Performed by Means of a DUMORE Grinder



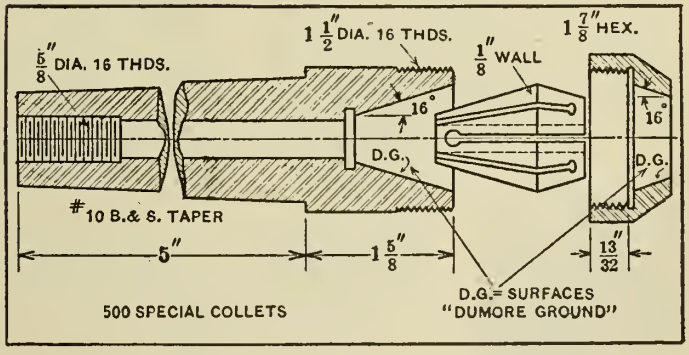
This photograph — taken at the City Engineering Company's (Dayton, Ohio) plant shows a Dumore Grinder finishing the main shank and head of a special draw-in collet. There were 500 put through in this special lot and the time for the operation shown averaged 8 minutes per piece.

The second operation; grinding the internal face of the collet nut, was also performed by this convenient precision tool.

Dumore Grinders are popular here as in every plant where fine tools are made. Their accuracy makes them useful for the finest finishing work; their simplicity and convenience make them practical for many difficult, almost inaccessible jobs.

Dumore Grinders transform any lathe into a precision grinder; they make fine finishing possible in every machine shop.

May we tell you more about them?



WISCONSIN ELECTRIC COMPANY

2929 SIXTEENTH STREET - - RACINE, WISCONSIN

DUMORE HIGH SPEED GRINDERS

Dealers Talk of Prices and Cancellations

Meeting Held in New York, Where These Matters Were Much Discussed—One Dealer Alone Speaks in Favor of a Reduction—How They Have Come Out on Cancellations.

REPORTS of the National Supply and Machinery Dealers' Association convention indicate that price recession and cancellations formed the chief topics of discussion, and that in the case of prices the sentiment was not at all favorable to urging for reductions. The opposite view to this was expressed by a Milwaukee dealer, who stated: "Prices must be made lower on machine tools, for the buying public expects it. I think that a general reduction is almost essential."

J. D. Doan, of the American Tool Works, Cincinnati, a manufacturer, who had at one time been a dealer, gave reasons which he said prevented a general reduction in the price of machine tools. He claimed that the wages of tool builders' labor had not been inflated as in the case of a certain stove manufacturer, whose molders had been getting from $15 to $30 a day. Therefore, wages could not be reduced. It costs about $40 a ton to make pig iron, he said, and iron is selling at that price now. So iron cannot be reduced. Moreover, thirty furnaces blew out in October, curtailing production. Neither is there great hope for a reduction of steel.

"There must be an honest-to-goodness reason for reduction of machine tools before any can take place," he continued. "I have had several instances called to my attention where business has not been placed because of the expectation of lower prices. A list would be issued; some dealer would quote a reduction on one tool, then the entire list would be held up, the purchasing agent expecting a general reduction. Our duty as an association is to stabilize confidence on the part of the buyers. One can't compare the machine tool industry with a more speculative one like the dry goods trade.

"If the cast iron entering one of our 18-in. lathes should be reduced 25 per cent., we could reduce the price of our finished machine not more than 3 per cent."

W. A. Viall, Brown & Sharpe Mfg. Co., Providence, R.I., agreed with the majority that prices could not be reduced at this time. He said that to-day there are no heavy stocks in the hands of the manufacturers. Their policy will be a receding one, tapering off production and placing in stock a few representative sizes. Nobody will take steps to increase plant capacities. Dealers can look forward to a period of quiet. The speaker had talked with several machinery men, some of whom placed the expected revival in April, others in July,

Probable Date of Revival

In the discussions, some named February as the month when the revival of business would set in. No one present admitted that he would be willing to reduce prices in order to liquidate stocks of tools on hand. In the matter of cancellations, all agreed that no two requests for cancellation could be handled exactly the same. The particular circumstances of the contract and the date of delivery of the tool would enter into the question. It was generally agreed that where delivery of machinery is delayed long after the specified time, the buyer may have legitimate reason for canceling. Many dealers had received such letters as this from buyers: "If you ship the tool, we shall be unable to pay for it."

One dealer narrated how the clause in his contract, stating: "No cancellations allowed without our consent," had been altered in recent contracts by striking out the last three words. A dealer suggested that buyers canceling be required to pay a certain percentage of the cost of the tool for the privilege, thus to compensate the dealer for his costs in making the sale.

TARIFFS DISCUSSED BY IRON AND STEEL MEN AT MONTREAL

Various phases of the iron and steel industry were brought out at the session of the tariff commission in Montreal. Some extracts follow:

W. W. Butler, on behalf of the iron and steel interests, upheld the need for a tariff to protect these industries. Steel and iron imports, he said, amounted for last year to $189,897,602, or 18 per cent. of the total imports. The bulk of pulp and paper machinery was imported, although the Canadian industry was now in a position to supply this material.

The Canadian industry was doubly hampered by having to import much of its raw material, and by the competition of a highly organized, well protected iron and steel industry in the United States.

The lead Great Britain once had in this industry had steadily decreased from the time free trade gave the protected German and Belgian iron and steel works an advantage in competition.

Adverse Exchange Rate

The purchase in the United States of goods which could be manufactured in Canada kept the exchange rate in an adverse position and unnecessarily increased the cost to Canadian consumers of other goods which are not manufactured here. At best the home market was none too large, and a long free list gave American companies an advantage in the Canadian market in many lines.

An enquiry by Sir Henry elicited the information that only the Algoma Mills were rolling structural steel, and they had just started. Apart from this, only small structural parts were made in Canada. Some lines which had been commenced lately by Canadian mills had had to be abandoned on account of United States competition. The American firms preferred their home market in time of shortage, and dumped their excess on the Canadian market in slack periods. The anti-dumping law, although good in principle, was not an absolute protection against dumping.

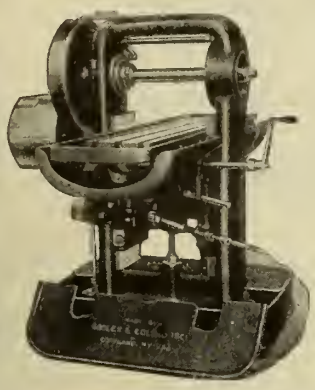
T. B. Howard, president of the Phoenix Iron Works, stated that the output of his industry had gone down very seriously since the war. This was an essential Canadian industry, and worthy of protection.

Sir Henry suggested that part of the Canadian structural people's troubles resulted from the fact that they had to buy structural steel from firms who later competed with them structurally. Would it not be to their advantage to have structural steel manufactured here?

Mr. Howard agreed that it would. If the Algoma company developed in this direction it would be of great use to them.

The industry had attracted to itself $26,000,000, represented by expensively equipped shops. It provided a field of employment for many university graduates and scientifically trained men. Its mechanics were highly skilled and big wages were paid to its construction workers. The United States firms had the advantage in climatic conditions and larger contracts and could therefore easily invade the Canadian market.

James Percy McNaughton, who for nearly twenty years has been general sales agent for the Dominion Iron and Steel Company at Montreal, passed away this week after a brief illness. Before associating himself with the steel company, Mr. McNaughton was in partnership in a brokerage business under the firm name of Lamplough and McNaughton. He was born in Ottawa 53 years ago. He leaves a widow and two sons.



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LIST OF METAL WORKING MACHINERY IN DUFFERIN STREET WAREHOUSE, TORONTO



Lathes—Engine

All sizes of Engine Lathes for 7" x 32 to 36" x 18' with D.B.G. or S.B.G., some with taper attachments.

Lathes, Gap

1—C.M.C. 20" x 36" x 12' Q.C.G., D.B.G., taper attachment.
1—South Bend 21" x 30" x 7' D.B.G., taper attachment.
1—Perfect 12" x 17½" x 6' Gap Engine Lathe.
1—McDougal 22 x 40 x 18 D.B.G. Gap Engine Lathe.
1—Bertram 38 x 54 x 12 Gap Lathe.
1—LeBlond 33 x 60 x 16 D.B.G. and Q.C.G. complete with chucks.

Turret Machines

Milholland, Davis, Oliver make of various sizes and capacities, with full equipment.

Screw Machines

Foster, Prentice, Warner & Swasey and Cleveland, National Acme Automatics.

Drills

3—Woodward & Rogers 4-spindle, ½ in. capacity.
1—Edlund 1B High Speed Sensitive.
1—3-Spindle Silver Gang Drill.
1—20" Rockwell B.G. Power Drill.
1—20" Silver Drill, all geared.
2—20" Champion, all geared Power Drills.
1—36" Bertram B.G. Drill.
1—36" D8 Colburn Drill.
2—No. 1 Burke 10" Sensitive Bench.

Shapers

1—24" McGregor-Gourlay.
1—16" Rae Shaper.
1—14" McKenzie Shaper.
3—14" Davis Crank Shapers.

Grinders

1—12 x 42 Landis Plain Grinder.
1— 8 x 36 Fitchburg Cylindrical.
1—10 x 25 Q.C. Bath Universal.
1—No. 12 Gardner Disc Grinder.
1—Globe Universal Tool and Cutter Grinder
1—Stevens Universal Tool and Cutter Grinder.
1—Lafayette Universal Grinder for lathes.
2—Whitney No. 23 Internal Grinders, Emery Grinders, Pedestal, bench type.

Millers

2—Briggs Type B42 Traverse (manufact'g).
1—Briggs Type A22 Traverse (manufact'g).
1—No. 1 Bertram Universal with Dividing Heads.
1—No. 2 Ford-Smith Plain Miller.

Compressors

1—12 x 13 Bury with tank and fittings.
1—10 x 18 Belt Driven Ingersoll-Rand.
1—8 x 8 Sullivan Compressor.

Shears, Punches, etc.

1—Ryerson No. 3 Rotary Bevel Shear, 1 in. capacity.
1—4 in. Stroke Double Arch Press Geared.
1—Lennox Rotary Splitting Shear, 24" stroke capacity, ½" plate.
Several small Punches and Shears to ½ in. capacity.

Hack Saws

1—Racine No. 10 Power Hack Saw, 8 x 8 capacity.
1—Peerless Power Hack Saw, 6 x 6 capacity.

Furnaces

1—Bellevue Double Chamber Oil Furnace.
1—12 x 15 x 8 Gas Furnace.
1—18 x 11½ x 8 Gas Furnace (West Magott).
1—24 x 18 x 12 Oil Furnace (Gilbert & Barker), with tank blower and pyrometer.

Miscellaneous

1—Morris Portable Crane, 1½-ton capacity, 10 ft. lift.
1—Canton No. 2 Portable 2-ton Crane.
1—Canton No. 2 Portable 1-ton Crane.
Several Hydraulic and Vacuum Pumps.
Several Blowers, Pressure and Exhaust Fans.
Grant Rotary Riveter, capacity 3-16.
Dividing Head for Miller.
Miller Vise.
Several Chucks.
Valve Milling Machines.
Transmission Supplies.
Several Greenard Arbor Presses.

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We have complete stock of machines for all woodworking operations.

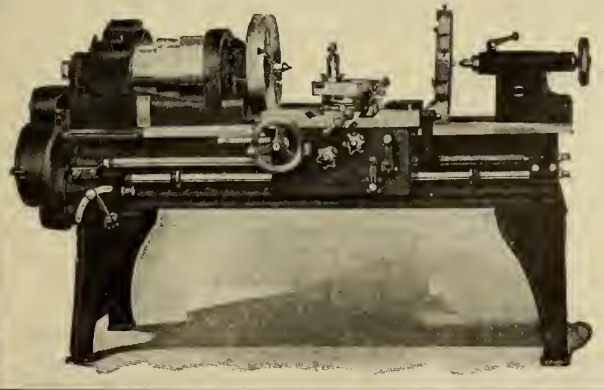
Boring Mills

1—Bement-Niles 66" 2 heads—25" under cross rail.
1—Niles 38" Vertical Boring Mill.
1—Bertram Horizontal 3½" Spindle, 60" between centers.
1—Universal No. 2½ Horizontal Boring Machine.

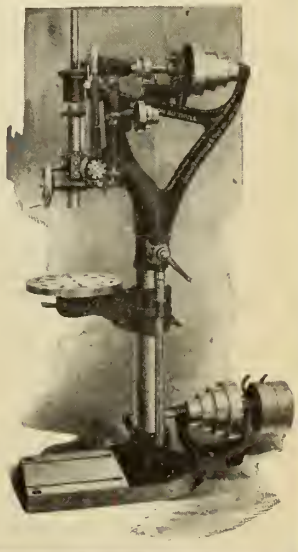
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It Costs Money To Build High-Class Tools

President Newton Reviews the Outlook at New York Gathering—Necessary to Have Best Workmen to Keep Up the Standard—Cutting Prices Does Not Help Matters

ADDRESSING the nineteenth annual convention of the National Machine Tool Builders' Association at the Hotel Astor, New York, President Albert E. Newton, after reviewing the business situation, said that "any reduction in prices on machine tools will not stimulate demand, and is more likely to work to the contrary."

"For the past few months business in general has been on a down grade," stated Mr. Newton, "attaining greater velocity as the time went on, so that now, even if the brakes were set hard, we could not expect to stop the downward trend at once. Therefore, let us face the situation as it is, and realize that we are face to face with a real depression, and that the orders for machine tools are few and far between.

"Let us ask what are we going to do about it? Can we by any act of ours better the situation? The answer is 'no.' Most of us know from experience that the demand, or lack of demand, for machine tools is entirely beyond the control of the machine tool builders. We also know that any reduction in prices on machine tools will not stimulate the demand, and is more likely to work to the contrary.

"We should realize that the present condition of our industry requires us to be calm and courageous, think clearly and deliberately, and deal in facts and not theory.

"During the past five years the machine tool industry, as a whole, has not increased its prices as much as the costs have increased, and today our margin of profit is not on as a high a plane as it should be. Bear in mind that we must continue to improve our product, and that experimental and development work is a necessary part of the cost of machine tools. Also, that to produce a high-grade machine we must have high-grade workmen, and to secure and keep high-grade workmen, we must grant comparatively high wages.

"There is only one cause that I know of that should either increase or decrease the price of a machine tool, and that is cost, and I submit that our costs are today higher than ever before. It has been stated, and I believe it to be true, that the recent increase in freight rates will add 5 per cent. to this cost.

"We know that decreased production means higher overhead cost, so that even if our raw materials may cost us less in the near future (and I am not so sure that this will happen), this possible saving will be more than offset by the increased overhead cost due to reduced output.

"The depression with which we are now contending is no new experience for us, and is not a surprise, as we have been expecting it for some time; in 1913-'14 we experienced a situation in the machine tool industry very similar, if not wore than that which we are now passing through; that experience taught us the real value of our association, a value that has never, and can never, be too highly rated.

"I believe that most of our members fully realize that the values which accrue to them from the fruits of our association are proportionate to the time and mutual support given by them, and that our collective future as members of the National Machine Tool Builders' Association is dependent upon the unselfish and friendly co-operation of each individual.

Cancellations of Orders

"There is another important subject which always appears in times such as we have with us at present; that is, the cancellation of orders.

"It certainly would seem reasonable that an industry such as ours, which of necessity must purchase in advance its materials and supplies, sufficient to last for months, should be protected from indiscriminate cancellation of the orders on which it has based its plans.

"I hope that we may some time solve this condition and adopt some method that will raise the order for a machine tool to the dignity of a real contract, rather than a mere option that may be given up at will by the purchaser.

"It is an old saying, 'If you want a short war, prepare for a long one.' Let us attack this depression as though we thought it would last for some time; let us conserve our energies (meaning cash) so that whatever comes we shall be able to meet conditions in a business-like manner. Then we shall be ready to resume our full productive capacity when the demand for our product comes back to us, as it surely will in the not very distant future."

At the election of officers of the National Machine Tool Builders' Association, August H. Tuechter, of the Cincinnati-Bickford Tool Co., Cincinnati, was elected president, succeeding Albert E. Newton. Mr. Newton continues as a member of the executive committee. Other officers elected were: First vice-president, E. J. Kearney, Kearney & Trecker Co., Milwaukee, Wis.; second vice-president, C. Wood Walter, Cincinnati Milling Machine Co., Cincinnati; secretary, Carl E. Deitz, Norton Co., Worcester, Mass.; treasurer, Winslow Blanchard, Blanchard Machine Co., Cambridge, Mass.

Winnipeg Bridge.—The Winnipeg City Council are to be recommended by the civic committee on works to advertise for tenders for building the Maryland Bridge. Plans and specifications have been prepared and tenders must be made by December 14. It is specified that the bridge be completed ready for traffic by November 1, 1921, and that the entire structure, entailing railings and other features, must be completed by July 15, 1922. The final cost will approximate $300,000, and a penalty clause of $50 a day is to be included in any contract made. Traffic will be maintained over the bridge by temporary arrangements.

Plants Are Busy.—A despatch from Hamilton stated that one of the busiest spots there is at the National Steel Car Co. This concern has 844 men on its payroll, exclusive of the office and sales departments. While not a few Hamilton manufacturing plants have begun to retrench to a moderate degree, this large concern has found it necessary to put on a night shift, with the result that the important feature of its output is from 20 to 24 box cars per day for the government railways. These cars have a capacity of 40 tons. They are built to carry grain. Every afternoon the preceding day's output is hauled from the company's yards, and thence to Western Canada as fast as they can be taken there, to assist in expediting the movement of grain to the head of the lakes. In addition to the order for box cars for the government's railways, which was reported to be for 1,500, a large order has also been secured from the C. P. R. for flat cars. The C. P. R. has also placed its order for several all-steel sleepers. With the exception of the wheels, these sleepers, like all other cars built by the company, will be constructed completely at its local plant, and when shunted to its yards will be ready for service.

Thomas Findley, who for some years has held the dual office of president and general manager of the Massey-Harris Company, Limited, has resigned from the latter position, and in his place the board has appointed Thomas Bradshaw general manager. Mr. Bradshaw will be assisted by C. L. Wisner as assistant general manager in charge of sales, and by George Valentine as assistant general manager in charge of manufacturing. Mr. Findley, whose health has much improved of late, as president will continue to act as the company's chief executive.

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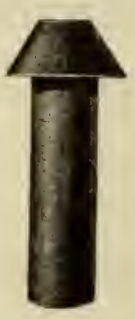
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BULLETIN ON REQUEST

General Combustion Co., of Canada, Limited

619-623 New Birks Bldg., Montreal

Trade Gossip

Howard S. Dick has been appointed city engineer of Kingston. He graduated from Queens in 1913, and was overseas with the Canadian Engineers.

Enlarged Foundry — The Canadian Hanson & Van Winkle Co., Toronto, have completed a large addition to their foundry, for the handling of gray iron castings, especially soft machine castings for the machine trade.

Have More Power.—The Hydro power cut in Kitchener has been reduced to 10 per cent. as the result of a number of industries agreeing to use electrical power at night. These factories have arranged to take a flat load over 24 hours rather than a heavy day load of 10 hours.

The United States furnished the entire supply of candles used in Cuba in 1918, which amounted to $1,492,027.

AUTOMATIC MILLING MACHINE

(Continued from page 482)

of helical gears and the main spindle gear is of herring-bone type, thereby eliminating tooth chatter. The overhanging arm is made in rigid form in the centre of machine, carrying a support extending to each arbor. Provision is made in these supports for a vertical adjustment. The cutter arbor is supported at its outer bearing in a phosphor bronze bushing.

The oiling system has been given special attention, all bearings being oiled from reservoirs. The spindle bearings are lubricated by sight feed drip oilers. In addition to the above there are three reservoirs with piping leading to other bearings of the machine. Reservoirs are provided with covers to prevent chips and dirt from getting into the same. Lubrication for the cutters is supplied by a geared pump. The vise is of a new design, its construction being very compact, without any loss of capacity. The driving pulley is 14 inches diameter and is driven from a countershaft, a 3½ inch belt being used.

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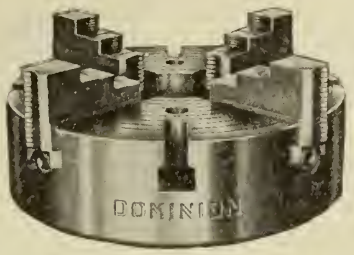
(Continued from Page 476.)

portation of oil from Baku is greatly reduced because of the lack of railroad transportation and the difficulty of passing through Georgia. The estimated production for 1919 is 1,257,000,000 gallons.

The average production of wells, which was 4,400 gallons per 24 hours in 1904, was 1,445 gallons in 1917, 1,165 gallons in 1918 and 1,730 gallons in 1919. Since the war the drilling of new wells has shown a constant decrease, falling from an average of 37,720 feet per month in 1913 to 13,120 feet at the end of 1917 and 1,400 feet at the end of 1918. For 1919 the average is still lower.

Meanwhile living expenses are very high, materials scarce and high priced; though the government is making every effort to relieve the situation, which is one that affects the industries of the whole world and especially those of the United States by the unprecedented demand the low output of the Russian oilfields causes to be placed upon those of the United States.

High Priced Coal.—Notwithstanding a general decrease in the prices of foodstuffs, Windsor dealers increased the price of anthracite coal to $26 a ton, approximately $10 more than the price being charged in Detroit. The difference in exchange and a shortage of coal are responsible for the step, it was explained.



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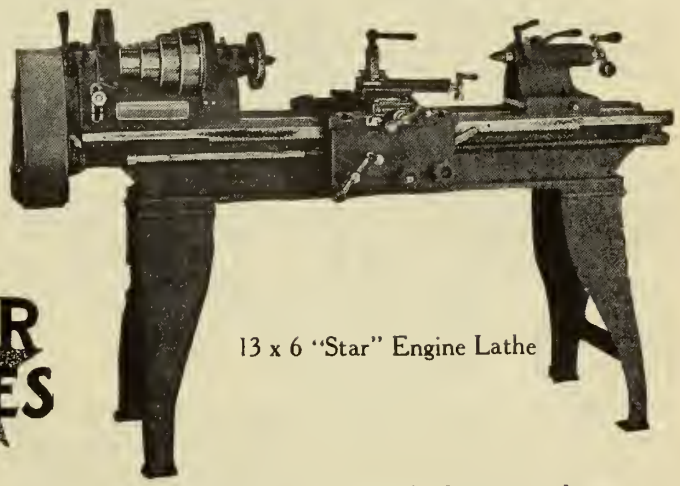
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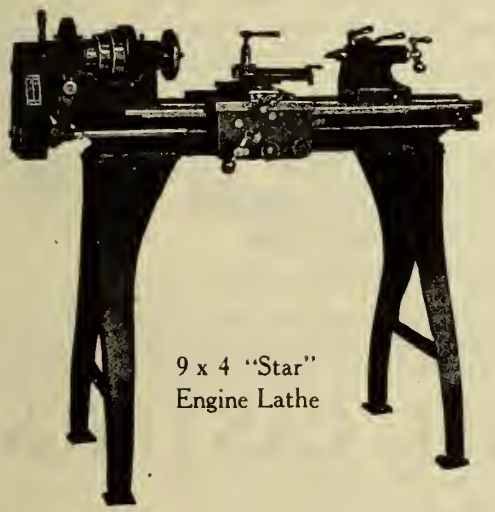
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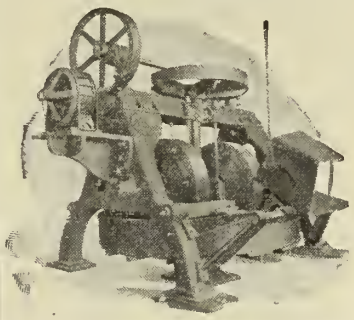
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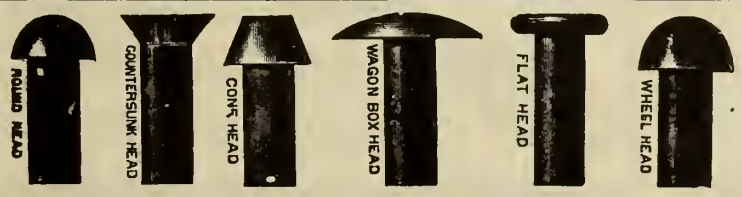
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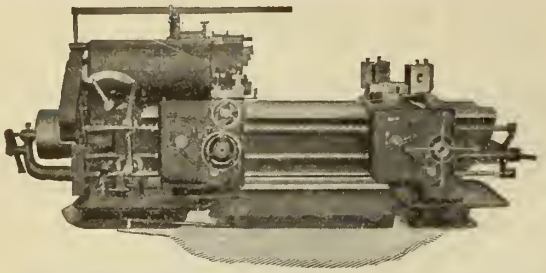
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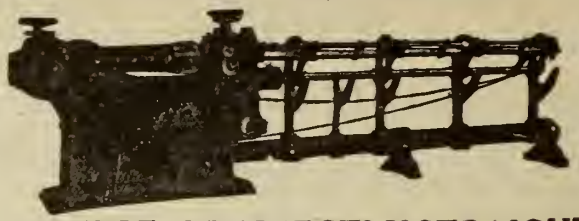
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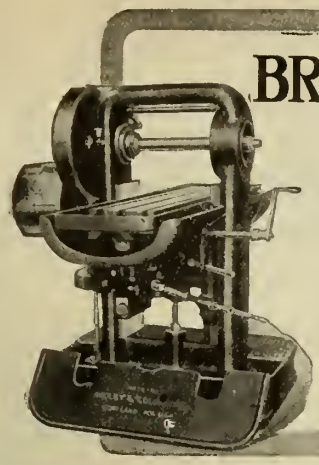
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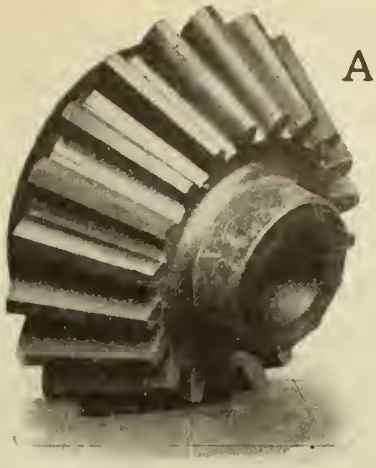
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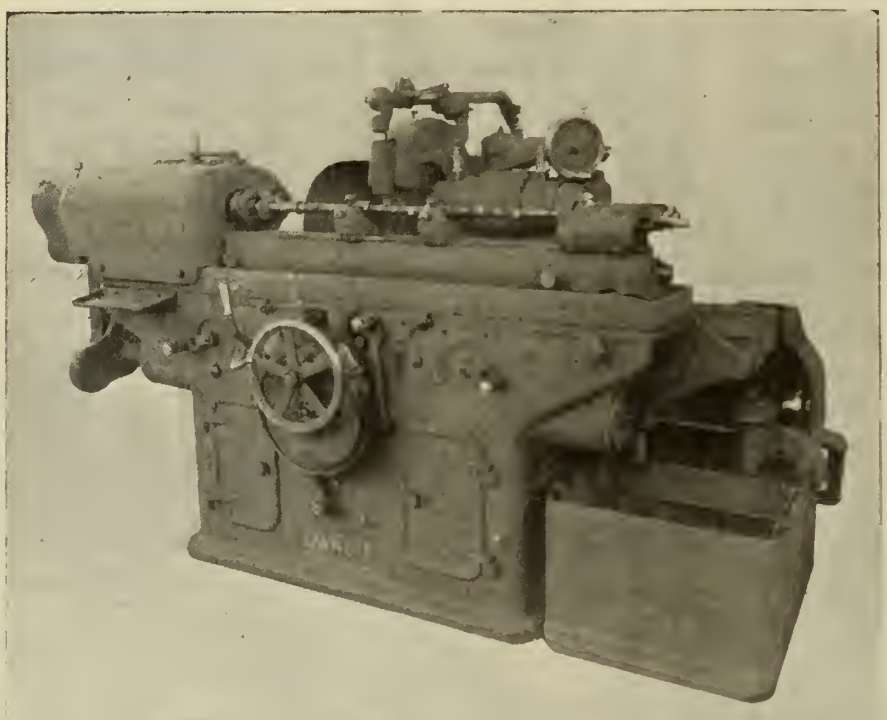
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Chapman Double Ball Bearing Company, Toronto.
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Lyman Tube & Supply Co., Montreal, Que.
Marshall Son & Bunney, Toronto.
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Cleveland Wire Spring Co., Cleveland.

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Marshall, Son & Bunney, Toronto.
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Franklin Mfg. Co., Syracuse, N.Y.
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Wells Bros. Co., of Canada, Galt, Ont.

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Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machinery Co., Toronto.
Lyman Tube & Supply Co., Montreal, Q.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.
Renold of Canada, Ltd., Montreal.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Renold of Canada, Ltd., Montreal.
Williams Mchy. Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Can. Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N. Y.
Glasgow, N.S.
Renold of Canada, Ltd., Montreal.

CHAINS, SPROCKET WHEEL
Can. Link Belt Co., Ltd., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Ltd., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Labatory, Ltd., Toronto.

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, COLLET, AIR
Petrie, Ltd., H. W., Toronto.
Williams Mchy. Co., A. R., Toronto.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford
Foss Mchy. & Sply Co., Montreal.
Gardner, Robt. & Son, Montreal.
Garlock-Walker Machinery Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Herbert, Ltd., Alfred, Toronto, Ont.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Strelinger, Chas. A. Co., Windsor, Ont.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Warner & Swasey Co., Cleveland, O.
Williams Mchy. Co., A. R., Toronto, Ont.

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAY FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York, N.Y.

CLOCK SPRINGS
The Dunbar Brothers Co., Bristol, Conn

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.

CLOSETS
Crane, Ltd., Montreal, Que

CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

COAL CRUSHERS
Can. Link-Belt Co., Ltd., Toronto, Ont.

COAL HANDLING MACHINERY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Nova Scotia Steel & Coal Co., New

COLD ROLLED STRIP, ALL METAL COLLARS, SHAFTING
Can. Driver-Harris Co., Ltd., Walkerville.
Williams & Co., J. H., Brooklyn, N.Y.

COLLECTORS, PNEUMATIC
Can. Blower & Forge Co., Kitchener
Sturtevant Co., B. F., Galt, Ont.

COMPOSITION INGOT
Canada Metal Co., Toronto.

COMPOUNDS, CUTTING AND GRINDING, DRAWING STAMPING
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR
Atkins & Co., E. C., Hamilton, Ont.
Can. Ingersoll-Rand Co., Sherbrooke.
Cleveland Pneumatic Tool Co., Toronto
Curtis Pneumatic Machy. Co., St. Louis
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Superior Machinery Co., London, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CONDENSERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
MacGovern & Co., Montreal, Que.

CONDUITS
Northern Electric Co., Ltd., Montreal, Que.

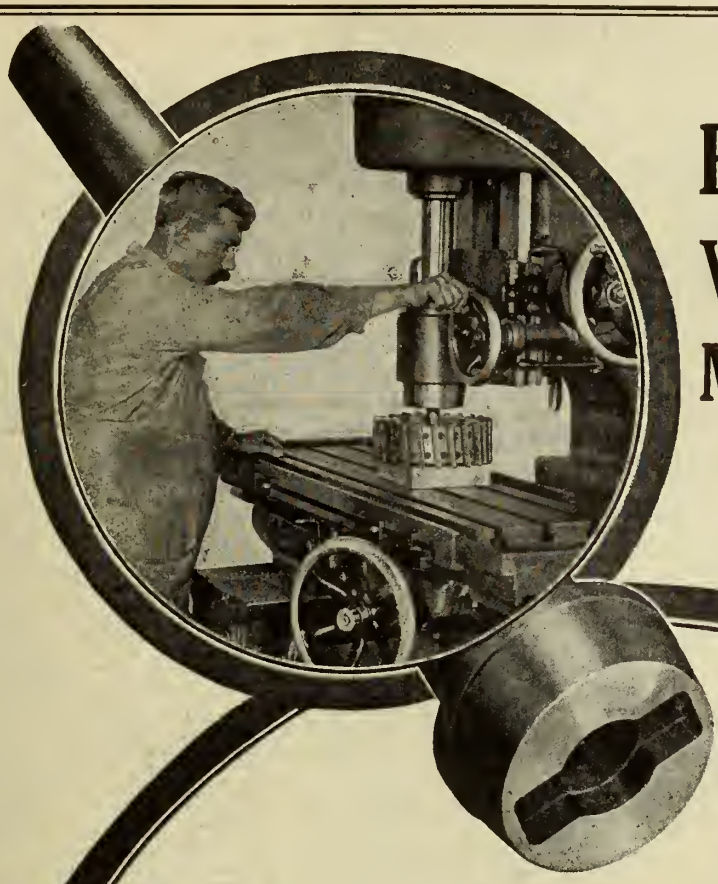
CONNECTING RODS
Canada Found'n & Forgings, Ltd., Welland, Ont.

CONNECTING ROD CUTTERS INTERCHANGEABLE
Eclipse Counter bore Co., Ltd., Walkerville, Ont.

CONTRACT WORK
Brown Engineering Corp., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
Globe Engineering Co., Hamilton, Ont.
Katie Foundry, Ltd., Galt, Ont.
Victoria Foundry Co., Ottawa.

CONTROLLERS, MAGNETIC BRAKES, ELECTRIC WINCHES, MONO RAIL HOISTS
Volta Mfg. Co., Welland, Ont.

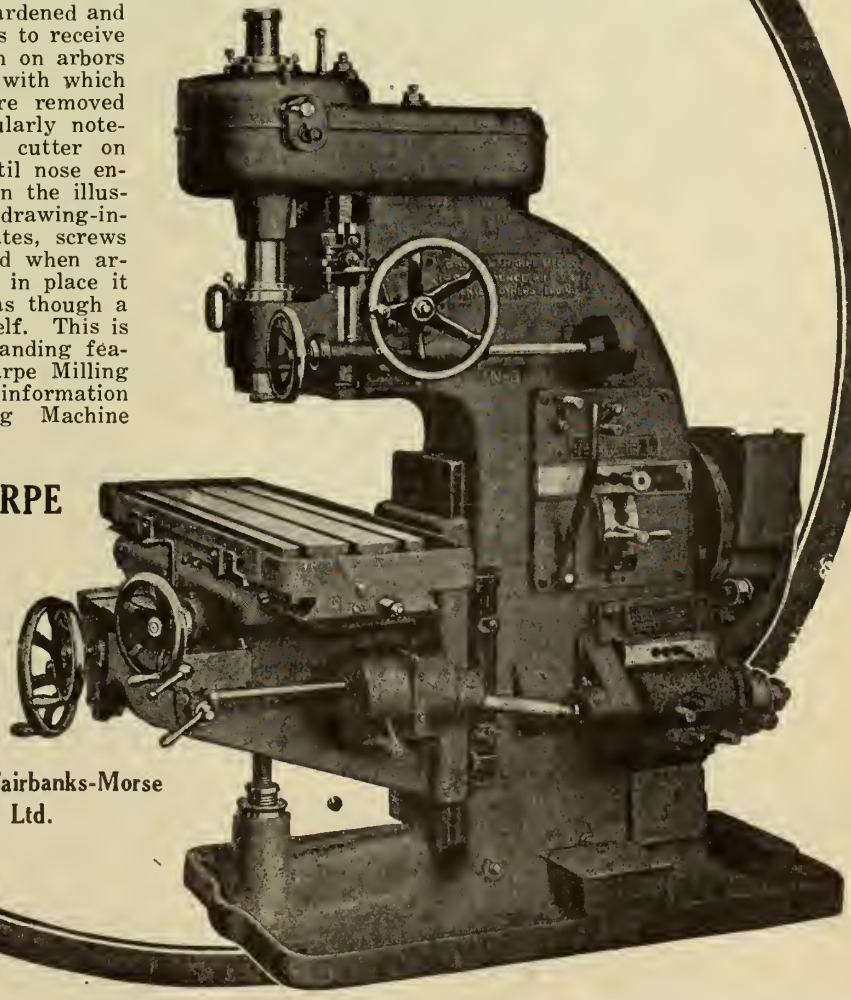
CONTROLLERS AND STARTERS
Williams Mach'y Co., A. R., Toronto



BROWN & SHARPE VERTICAL SPINDLE MILLING MACHINES

THE TAPER NOSE SPINDLE

assures a positive cutter drive under all conditions. The front end of spindle is tapered, hardened and ground and has a recess to receive cutter driver and clutch on arbors and collets. The ease with which face milling cutters are removed and replaced is particularly noteworthy—simply place cutter on table, lower spindle until nose enters cutter, as shown in the illustration and tighten drawing-in-bolt. There are no plates, screws or loose parts used and when arbor, collet or cutter is in place it is essentially as firm as though a part of the spindle itself. This is one of the many outstanding features of Brown & Sharpe Milling Machines. For further information send for our Milling Machine Book.



BROWN & SHARPE MFG. CO.

PROVIDENCE, R.I.
U.S.A.

Canadian Representative;

The Canadian Fairbanks-Morse Co. Ltd.

If interested tear out this page and place with letters to be answered.

CONTROLLING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

CONVERTERS, ROTARY
MacGovern & Co., Montreal, Que.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.

COOLERS, WITH DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co. Haydenville, Mass.

COPING MACHINES
Bertram & Sons Co., John, Dundas, Ont.
Dom. Steel Products Co., Ltd., Brantford
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Can. Blower & Forge Co., Kitchener.

COPPER, BUS BAR, SHEET, PLATES, RODS
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper and Brass Rolling Mills, New Toronto.

CORE OIL
Swan & Finch, Inc., 165 Broadway.

COUNTERBORES AND COUNTERSINKS
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.

COUNTERSINKS, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

COUNTERBORES, INVERTED, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

COUNTERSHAFTS
Almond Mfg. Co., Ashburnham, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Baird Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., Ltd., A. R., Montreal
Williams Mchy Co., A. R., Toronto.

COUPLINGS, FRICTION
Bernard Industrial Co., The A., Fortierville, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto.

COUPLINGS, RAPID HOSE
Ont. Machinery & Supply Co., Ltd., Montreal, Que.

COILING MACHINERY, WIRE AND SPRING
Garlock-Walker Machinery Co., Toronto.

BUCKET
Hanna & Co., M. A., Cleveland, O.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Cleveland Pneumatic Tool Co. of Canada, Toronto.

CRANES, OVERHEAD, HAND AND
Gardner, Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Northern Crane Works, Walkerville.

ELECTRIC
Volta Manufacturing Co., Welland, Ont.

CUPS, OIL
Can. Winkley Co., Ltd., Windsor, Ont.

COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.

CRANES, GRAVITY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

CRANE RUNWAYS
MacKinnon Steel Co., Sherbrooke, Que.

CRANES, JIB
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, LOCOMOTIVE
Brown Hoisting Machinery Co., Cleveland, Ohio.
Holden Co., Ltd., Montreal, Que.

CRANES, GOLLIATH, PNEUMATIC AND PORTABLE
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane and Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Petrie, Ltd., H. W., Toronto.

CRANES, PILLAR
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy. Co., A. R. Toronto, Ont.

CRANES, TRAVELLING, ELECTRIC AND HAND POWER
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Oliver Engineering Co., Montreal.

CRANK SHAFTS
Can. Found's & Forgings Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.

CRANK PIN TURNING MACHINE
Herbert, Ltd., Alfred, Toronto, Ont.

CRIMPS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass.

CRUSHERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.

CUPOLAS
Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.

CURB PUMPS FOR OIL, GASOLINE
Bowser Co., Ltd., S. F., Toronto, Ont.

CURRENT TRANSFORMERS
Volta Manufacturing Co., Welland, Ont.

CUT-OFF COUPLINGS, FRICTION
Petrie, Ltd., H. W., Toronto.

CUTTERS, BOLT
See Bolt Cutters.

CUTTERS, GEARS
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto

CUTTER HEADS
Oliver Machinery Co., Grand Rapids, Mich.

CUTTERS, PIPE (See Pipe Cutters)

CUTTERS, HIGH SPEED
Madison Mfg. Co., Madison, Wis.

CUTTERS, MILLING
Butterfield & Co., Rock Island, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Sply. Co., G. E., Montreal.
Garvin Machine Co., New York.
Ingersoll Machy. Co., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg. Co., Hartford, Conn.
Wilt Twist Drill Co., Walkerville, Ont.

CUTTER RELIEVING MACHINES
Cleveland Milling Machine Co., Cleveland

CUTTING-OFF MACHINES
Armstrong Bros., Tool Co., Chicago.
Atkins & Co., E. C., Hamilton, Ont.
Bertram & Sons Co., John, Dundas.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
G. F. Foss Mchy. & Sply. Co., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass.
Kennedy & Sons, Wm., Owen Sound
Lyman Tube & Supply Co., Montreal, Que.
Niles-Bement-Pond Co., New York.
Prest-O-Lite Co., Inc., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Williams Tool Corp. of Canada, Ltd., Brantford, Ont.
Wells Bros., of Can., Galt Ont.
Williams Mchy. Co., A. R., Toronto, Ont.

CUTTING COMPOUND AND CUTTING OIL
Cataract Refining Co., Ltd., Toronto.
Swan & Finch, Inc., New York.

CUTTING OIL, RECLAIMING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

CUTTING AND WELDING PLANTS
Davis-Bournonville Co., Jersey City, N.J.
Prest-O-Lite Co., Inc., Toronto, Ont.

CYANIDE AND LEAD BATH POTS
Swedish Crucible Steel Co., Windsor.

CYLINDERS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton, Ont.

REHUMIDIFYING
B. F. Sturtevant Co., Galt, Ont.

DERRICKS
Aikenhead Hardware Co., Toronto, Ont.
Dominion Bridge Co., Montreal.
Hepburn Co., Ltd., J. T., Toronto, Ont.
Morris Crane & Hoist Co., Sherbrook.

DIAMOND (BORTZ)
Furniss, Clarke & Co., Montreal, Que.

DIAMOND TOOLS
Can. Desmond-Stephan Mfg. Co., Hamilton.
Ford-Smith Machine Co., Hamilton, Ont.
Furniss Clark & Co., Montreal, Que.
Joyce-Koehel Co., Inc., New York City
Wheel Trueing Tool Co., Detroit.
Petrie Ltd., H. W., Toronto.

DIAMONDS, CARBON AND BORTZ
Joyce Koehel Co., Inc., New York, N.Y.
Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.

DIE CASTINGS
Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

DIE HEADS, AUTOMATIC
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

DIES FOR BIT BRACE USE
Butterfield & Co., Rock Island, Que.
Crescent Mchc. Co., Ltd., Montreal, P.Q.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Wells Brothers Co., of Canada, Galt.

DIES AND DIE STOCKS
Ackworthie Ltd., J., Birmingham, Eng.
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Brown, Boggs Co., Hamilton, Ont.
Crescent Mchc. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
Herbert Ltd., Alfred, Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Jones & Lamson, Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Brothers of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DIES, HAMMERED
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, DROP FORGE.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, METAL STAMPING
Ackworthie Ltd., J., Birmingham, Eng.
Crescent Mchc. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall, Galt, Ont.

DIES, PIPE THREADING
Ackworthie Ltd., J., Birmingham, Eng.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Crescent Mchc. Co., Ltd., Montreal, P.Q.
Landis Machine Co., Waynesboro, Pa.

DIES, THREADING
Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Crescent Machine Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

DIE SINKERS
Ackworthie Ltd., J., Birmingham, Eng.
Garvin Machine Co., New York.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.
Pratt & Whitney Co., Dundas, Ont.
Walcott Lathe Co., Jackson, Mich

DIES FOR MACHINES
Ackworthie Ltd., J., Birmingham, Eng.
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt.

DIE HEADS
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Canada, Galt, Ont.

DIES, SELF-OPENING
Geometric Tool Co., New Haven.
Herbert, Ltd., Alfred, Toronto, Ont.
Landis Machine Co., Waynesboro, Pa.
Morchey Machine & Tool Co., Detroit.
Wells Brothers Co. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.

DIE FILING MACHINES
Oliver Mach. Co., Grand Rapids, Mich

DIE STEEL, HOT AND COLD WORK
Armstrong-Whitworth of Can., Montreal
Atkins & Co., Ltd., Wm., Sheffield, Eng
Marshall, Son & Bunney, Toronto.
Firth & Sons, Thos., Montreal, Que.

DIES FOR SCREW PLATES
Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Wells Bros. Co. of Can., Galt, Ont.

DIES, SHEET METAL WORKING
Ackworthie Ltd., J., Birmingham, Eng.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Globe Engineering Co., Hamilton, Ont.
Stoll Co., D. H., Buffalo, N.Y.

DIES, SCREW AND THREAD
Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros., Co., of Can., Galt, Ont

DISCS, LEATHER, STEEL
Graton & Knight Mfg. Co., Worcester Mass.

DIRECT CONNECTED UNITS
MacGovern & Co., Montreal, Que.

DRAFT, MECHANICAL
Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sturtevant Co., B. F., Galt, Ont.

DRAINAGE FITTINGS
Crane, Ltd., Montreal, Que.

DRAWING INSTRUMENTS
Hughes, Owens Co., Ltd., Montreal, Que

DRAWING OFFICE SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

DRESSERS, GRINDING AND EMERY WHEEL
Atkins & Co., E. C., Hamilton, Ont.
Can. Desmond-Stephan Mfg. Co., Hamilton
Dominion Abrasive Co., Ltd., Mimico, Ont
Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont.

DRILL PRESSES
Can. Blower & Forge Co., Kitchener.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
U. S. Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto.

DRILL RODS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Lincoln Electric Co of Canada, Ltd., Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Swedish Steel & Importing Co., Ltd., Montreal.

DRILLING MACHINES, GANG
Bilton Mach. Tool Co., Bridgeport, Conn
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Silver Mfg. Co., Salem, Ohio.
Strelinger, Chas. A. Co., Windsor, Ont.

DRILLING MACHINES, LOCOMOTIVE AND MULTIPLE SPINDLE
John Bertram & Sons Co., Dundas.
Bilton Mach. Tool Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Mach. Co., Toronto.
Garvin Machine Co., New York.
Hoefer Mfg. Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
Nat. Automatic Tool Co., Richmond, Ind
Niles-Bement-Pond Co., New York.
Rockford Drilling Mach Co., Rockford, Ill
Strelinger, Chas. A. Co., Windsor, Ont.

DRILLING MACHINES, RADIAL AND TURRET
John Bertram & Sons Co., Dundas.
Canadian Fairbanks-Morse Co., Montreal
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Herbert, Ltd., Alfred, Toronto, Ont.
Henry & Wright Mfg. Co., Hartford,
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLING MACHINES, SENSITIVE
Bilton Mach. Tool Co., Bridgeport, Conn.
Canadian Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt, Ont.
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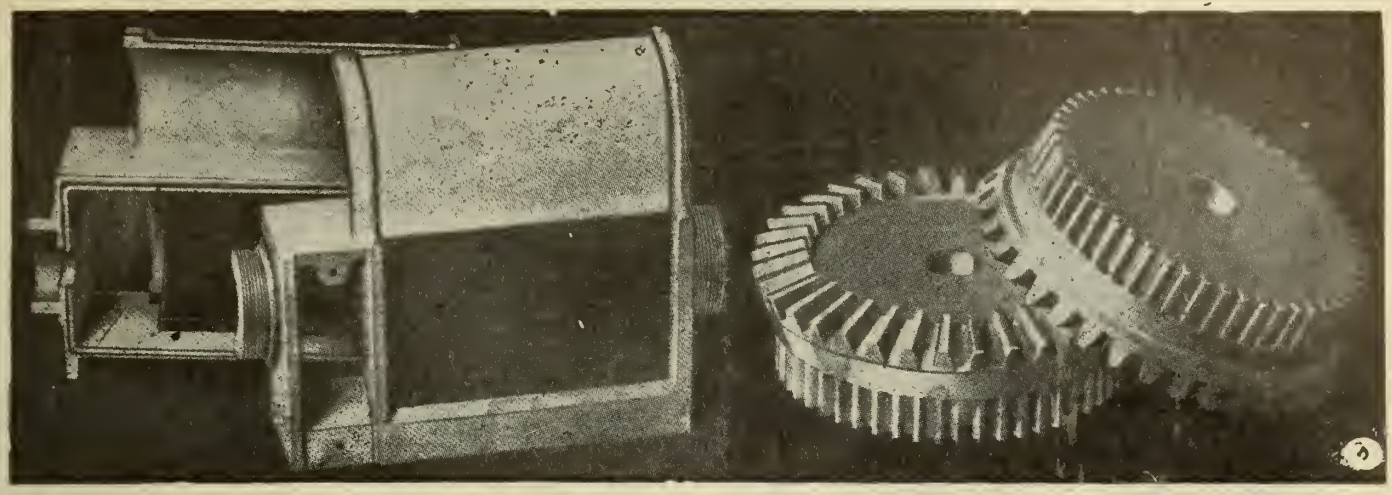
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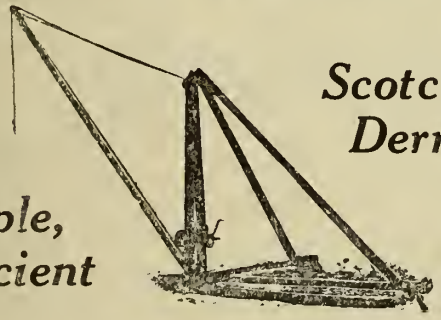
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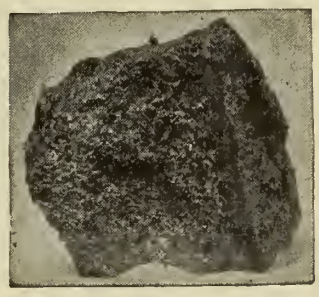
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Fellows Gear & Shaper Co., Springfield, V.

GEAR-CUTTING MACHINERY
Bilton Mach. Tool Co., Bridgeport, Conn.
Fellows Gear & Shaper Co., Springfield, V.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

GEAR-TESTING MACHINE
Gisholt Machine Co., Madison, Wis.

GEARS, CHAIN
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.
Renold of Canada Ltd., Montreal.

GEARS, COMPENSATING
Morse Chain Co., Ithaca, New York.
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, CUT, MORTISE, ANGLE, WORM
Can. Link-Belt Co., Toronto, Ont.
Diamond State Fibre Co., Bridgeport, Pa.
Dom. Steel Products Co., Ltd., Brantford.
Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Found., Ltd., Hull, Q.
Jones & Glasco, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
Victoria Foundry Co., Ottawa.

GEARS, RAWHIDE
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough.
Jones & Glasco, Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
A. R. Williams Machy. Co., Toronto.

GENERATORS, GEAR
Fellows Gear & Shaper Co., Springfield, V.

GEARS, SILENT CHAIN
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, SPRING
Morse Chain Co., Ithaca, New York.

GEARS, SPUN, BENCH, SPIRAL
Brown & Sharpe Mfg. Co., Providence, R.I.

GENERATORS AND CONVERTORS
Northern Elec. Co., Ltd., Montreal, P.Q.

GENERATORS, MOTOR
MacGovern & Co., Montreal
Northern Elec. Co., Ltd., Montreal, P.Q.
Sturtevant Co., B. F., Galt, Ont.

GENERATORS, STEAM TURBO
Can. Link-Belt Co., Ltd., Toronto, Ont.
Holden Co., L. C., Montreal, Que.

GILDING
Brown's Copper and Brass Rolling Mills New Toronto.

GLUE HEATERS
Oliver Machinery Co., Grand Rapids, Mich.

GLASSES, SAFETY
Willson Goggles, Inc., Reading, Pa.

GRAPHITE
Aikenhead Hardware, Ltd., Toronto.
Rice Lewis & Son, Toronto.

GOGGLES
Standard Optical Co., Geneva, N.Y.

GRAB BUCKETS—CLAMSHELL and ORANGE PEEL
Canadian Link-Belt Co., Ltd., Toronto, Ont.

GRAVITY CARRIERS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glasco, Montreal.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

GREASE CUPS, PRESSED STEEL, BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES (See Lubricants)

GRINDERS, AUTOMATIC KNIFE
Canada Machinery Corp., Galt, Ont.
Foss Mchry. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto

GRINDERS, AUTOMATIC SURFACE
La Salle Tool Co., La Salle, Ill.

GRINDERS, BENCH
Superior Machinery Co., London, Ont.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Can. Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Haskins & Co., R. C., Chicago, Ill.
Wisconsin Electric Co., Inc., Racine, Wis.
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Katz Foundry, Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec. Tool Co., Cincinnati.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy. Co., A. R., Toronto, Ont.

GRINDERS, CUTTER
Brown & Sharpe Mfg. Co., Providence, R.I.
Cincinnati Milling Mach. Co., Cincinnati.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gervin Machine Co., New York.
Globe Engineering Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Herbert, Ltd., Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, DIE AND CHASER
Haskins & Co., R. C., Chicago, Ill.
Landis Machine Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., E. C., Hamilton, Ont.
Ford-Smith Mach. Co., Hamilton.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., Worcester, Mass.

GRINDERS, FLEXIBLE CASTING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

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Aikenhead Hardware Co., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass.
La Salle Tool Co., La Salle, Ill.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Brown & Sharpe Mfg. Co., Providence, R.I.
Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, PORTABLE, ELECTRIC HAND, TOOL POST, FLOOR AND BENCH
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Mach. Co., Hamilton, Ont.
Haskins & Co., R. C., Chicago, Ill.
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
United States Elec. Tool Co., Cincinnati
Wisconsin Electric Co., Inc., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

GRINDERS, HOLE, HOLE AND AND DEEP HOLE
Barber Mchy. Co., Ltd., Toronto, Ont.
Bryant Chucking Grinder Co., Springfield, Vermont.
Heald Machine Co., Worcester, Mass.

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Cleveland Pneumatic Tool Co., Toronto.
Garlock-Walker Machinery Co., Toronto.
Heald Machine Co., Worcester, Mass.
Independent Pneumatic Tool Co., Chicago
MacGovern & Co., Montreal, Que.

GRINDERS, PROFILE
Cleveland Milling Machine Co., Cleveland.

GRINDERS, ROTARY SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I.
Bristol Machine Tool Co., Bristol, Conn.
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, TOOL AND HOLDER
Armstrong Bros. Tool Co., Chicago.
Blount & Co., J. G., Everet, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
Herbert, Ltd., Alfred, Toronto, Ont.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

GRINDERS, UNIVERSAL, PLAIN
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

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Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Heald Machine Co., Worcester, Mass.
Herbert, Ltd., Alfred, Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Norton Co. of Canada, Ltd., Hamilton, Ont
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Can. Fairbanks-Morse Co., Montreal.
Cincinnati Elec. Tool Co., Cincinnati, O.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Haskins & Co., R. C., Chicago, Ill.
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Herbert Ltd., Alfred, Toronto, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
Wisconsin Electric Co., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

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Brown & Sharpe Mfg. Co., Providence, R.I.
Norton Co. of Canada, Ltd., Hamilton, Ont.

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Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford.
Can. Fairbanks-Morse Co., Montreal.
Carborundum Co., Niagara Falls, N.Y.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Mchy. & S'ply Co. G. F. Montreal
Norton Co. of Canada, Ltd., Hamilton, Ont.

GRINDING WHEEL DRESSER
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Norton Co. of Canada, Ltd., Hamilton, Ont.

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Canada Machinery Corp., Galt, Ont.
Canada Wire & Iron Goods Co., Hamilton
Dennis Wire & Iron Works, London, Ont.
B. Greening Wire Co., Hamilton, Ont.

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H. H. Robertson, Ltd., Sarnia, Ont.

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Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Ford-Smith Machine Co., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Pilot Steel & Tool Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
L. S. Starrett Co., Athol, Mass.
Standard Machy. & Supplies, Montreal
Strelinger, Chas. A. Co., Windsor, Ont.
Victor Saw Works, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.
Williams Mchy Co., A. R., Toronto, Ont.

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Williams & Co., J. H., Brooklyn, N.Y.

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Can. Link-Belt Co., Ltd., Toronto, Ont.

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Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Gervin Machine Co., New York City.
Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.

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Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Foss Mchy. & S'ply Co., G. F., Montreal
Ford-Smith Machine Co., Hamilton.
Perfect Machine Co., Galt, Ont.
Starrett Co., L. S., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, ELECTRIC
Hoskins & Co., R. C., Chicago, Ill.

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Beaudry & Co., Boston, Mass.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton.
Canada Machinery Corp., Galt, Ont.
High Speed Hammer Co., Rochester, N.Y.
Jardine & Co., A. B., Hespeler, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

HAMMERS, HELVE POWER
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

HAMMERS, CHIPPING, CAULKING, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, NAIL MACHINE
Rice Lewis & Son, Toronto, Ont.
United Hammer Co., Boston, Mass.

HAMMERS, POWER
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, STEAM
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.

HAND PLANERS
Oliver Mchry. Co., Grand Rapids, Mich.

HAND PLANING AND JOINTING MACHINERY
Oliver Engineering Co., Montreal, P.Q.

HAND LEATHERS OR PADS
Graton & Knight Mfg. Co., Montreal.

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Diamond State Fibre Co., Bridgeport, Pa.

HANGERS
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian Link-Belt Co., Ltd., Toronto, Ont.

HANGERS, SHAFT
Algoma Steel Corp., Sault Ste. Marie.
Chapman Double Ball Bearing Co., Toronto.
Baird Machine Co., Bridgeport, Conn.
Can. S K F Co., Toronto, Ont.
Gardner & Son, Robt., Montreal.
Jones & Glasco, Montreal.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

HARDNESS TESTING INSTRUMENTS
Shore Instrument & Mfg. Co., New York.

HEAD, AUXILIARY
Hoefer Mfg. Co., Freeport, Ill.

HEATING AND VENTILATING ENGINEERS
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Sturtevant Co., B. F., Galt, Ont.

HEAT GAUGES, HARDENING AND ANNEALING
Shore Instrument & Mfg. Co., New York

HIGH SPEED STEEL
See Steel.

HINGE MACHINERY
Baird Machine Co., Bridgeport, Conn.

HINGES
Butterfield & Co., Inc., Rock Island, Que.
London Bolt & Hinge Wks., London, Ont.

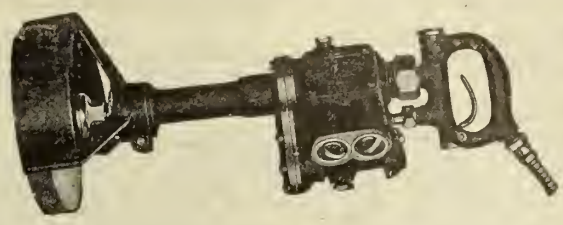
HOBS
Greenfield Tap & Die Co., Greenfield, Mass
Pratt & Whitney Co., Dundas, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Wells Bros. of Canada, Galt, Ont.

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Holden Co., Ltd., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

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Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Ford Chain Block & Mfg., Philadelphia
Independent Pneumatic Tool Co., Chicago
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
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Oliver Engineering Co., Montreal.
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Dominion Bridge Co., Montreal, Que.
Electric Steels & Metals Ltd., Welland.
Kennedy & Sons, Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

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Eclipse Counterbore Co., Ltd., Walkerville, Ont.

HOLDERS, ELECTRIC
Electric Steels & Metals, Ltd., Welland

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Clipper Belt Lacer Co., Grand Rapids.

HOPPERS
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Dominion Bridge Co., Montreal, Que.
William Hamilton Co., Peterboro, Ont.
Toronto Iron Works, Ltd., Toronto, Ont.

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International Mach. Sply, Ltd., Montreal

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Garlock-Walker Machinery Co., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Independent Pneumatic Tool Co., Chicago.
Quaker City Rubber Co., Philadelphia, Pa.
Wells Bros. Co. of Canada, Galt, Ont.

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Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

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Quaker City Rubber Co., Philadelphia, Pa.

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Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

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Eastern Production Co., Detroit, Mich.
Garlock-Walker Machinery Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Victoria Foundry Co., Ottawa.

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Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

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Taylor Instrument Co., Rochester, N.Y.

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Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

INDEX CENTRES
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Petrie, Ltd., H. W., Toronto.

INDICATING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

INDUSTRIAL SITES
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Electric Steel & Metals Co., Welland.

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Hanna & Co., M. A. Cleveland, O.

IRON, WROUGHT, ROLLED, PIG
Swedish Steel & Impt. Co., Ltd., Montreal

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Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
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Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.

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Canadian Fairbanks-Morse Co., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Northern Crane Works, Walkerville.

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Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford
Skinner Chuck Co., New Britain, Conn.

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Brown Engineering Corp., Toronto.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Gisholt Machine Co., Madison, Wis.
Globe Engineering Co., Ltd., Hamilton.
Jones & Lamson, Springfield, Vt.

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Dominion Foundries & Steel Ltd., Hamilton, Ont.

KEY SEATERS
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, M.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Machy. Co., A. R., Toronto.

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KILNS
Can. Blower & Forge Co., Kitchener, Ont.
General Combustion Co., Ltd., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

KNIVES, MACHINE
Atkins & Co., E. C., Hamilton, Ont.

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LADLES, FOUNDRY
Northern Crane Works, Walkerville.

LACING MACHINES
Clipper Belt Lacer Co., Grand Rapids, M.

LAG SCREW GIMLET POINTERS
National Machy. Co., Tiffin, Ohio.

LATH
Robertson, Ltd., H. H., Sarnia, Ont.

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Acme Machine Tool Co., Cincinnati, Ohio.
Petrie, Ltd., H. W., Toronto.

LATHE CHUCKS (See Chucks)

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Williams & Co., J. H., Brooklyn, N.Y.

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Herbert, Ltd., Alfred, Toronto, Ont.

LATHES, AXLE
Betts Mach. Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, BORING
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto
Strelinger, Chas. A. Co., Windsor, Ont.

LATHES, PRECISION, BENCH
J. G. Blount & Co., Everett, Mass.
Canadian Fairbanks-Morse Co., Montreal
Geo. F. Foss Machy. & Supply Co. Montreal.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Seneca Falls Mfg Co., Seneca Falls, N.Y.
Strelinger Co., C. A., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, BRASS
Ackworthie Ltd., J., Birmingham, Eng.
Acme Machine Tool Co. Cincinnati, Ohio.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co. A R Toronto, Ont.

LATHES, ENGINE
Acme Machine Tool Co., Cincinnati, O.
John Bertram & Sons, Co., Dundas.
Canada Machy. Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal.
G. F. Foss, Mchy. & S'ply Co., Montreal
Garlock-Walker Machinery Co, Toronto.
Garvin Machine Co., New York.
Gisholt Machine Co Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
Lehman Mach. Co., St. Louis, Mo.
R. McDougall Co., Galt.
Niles-Bement-Pond Co., New York.
Perfect Machine Co., Galt, Ont.
Standard Equipment & Tool Wks. Montreal, P.Q.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Sidney Tool Co., Sidney, Ohio.
Strelinger, Co., C. A., Windsor, Ont.
Walcott Lathe Co., Jackson, Mich
A. R. Williams Machy. Co. Toronto
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, FOOT POWER
Seneca Falls Mfg. Co., Seneca Falls, N.Y

LATHES, HORIZONTAL
Herbert, Ltd., Alfred, Toronto, Ont.
Internl. Mchy. Supplies Ltd., Montreal.

LATHES, JOURNAL TRUEING
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, PATTERNMAKERS'
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Can. Machinery Corp., Galt.
G. F. Foss Mchy. & S'ply Co., Montreal
Garlock-Walker Machy. Co., Toronto Ont

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Ackworthie Ltd., J., Birmingham, Eng.
Greenfield Tap & Die Corp., Greenfield
Wells Bros. of Canada, Galt, Ont.

LATHES, SCREW CUTTING
Bertram & Sons Co., John, Dundas, Ont.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & Sply Co., G. F., Montreal
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Lehman Machine Co., St. Louis, Mo.
Niles-Bement-Pond Co, New York.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Strelinger Co., C. A., Windsor, Ont.
Williams Machy. Co., A. R., Toronto.

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Bliss Co., E. W., Brooklyn, N.Y.

LATHES, TOOL ROOM
Canada Machinery Corporation, Galt, Ont
Lehman Machine Co., St. Louis, Mo.
Seneca Falls Mfg. Co., Seneca Falls, N.Y
Strelinger, Chas. A. Co., Windsor, Ont.

LATHES, QUICK CHANGE
Lehman Machine Co., St. Louis, Mo.

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Atkins & Co., E. C., Hamilton, Ont.

LATHES, TURRET
Acme Machine Tool Co., Cincinnati, Ohio
Herbert Ltd., Alfred, Toronto, Ont.

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British Smelting & Refining Co., Ltd., Montreal, Que.
Hoyt Metal Co., Toronto, Ont.

LEAD BURNING OUTFITS
Turner Brass Works, Sycamore, Ill

LEATHER STRAPPING
Graton & Knight Mfg. Co., Worcester, M

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Standard Optical Co., Geneva, N.Y.

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Hughes, Owens Co., Ltd., Montreal Que

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Can. Winkley Co., Ltd., Windsor, Ont.

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Bertrams, Ltd., Edinburgh, Scotland

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Canada Wire & Iron Gds. Co., Hamilton
Dennis Wire & Iron Works, London, Ont

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Katie Foundry, Galt, Ont.

MACHINE TOOLS
Barber Mach. Co., F. F., Toronto, Ont

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Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machy. Co., Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Machy. Co., A. R., Toronto.

MACHINERY GUARDS (See Guards)

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Crescent Machine Co., Ltd., Montreal
Globe Engineering Wks., Hamilton, Ont

MACHINERY, SPECIAL
Can. Ingersoll-Rand Co., Ltd. Sherbrooke Que.
Crescent Machine Co., Ltd., Montreal, Que.
McClean Machine & Tool Co., Ltd., Hamilton, Ont.

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Brown & Sharpe Mfg. Co., Providence, R.I
Starrett Co., L. S., Athol, Mass.

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Volta Mfg. Co., Welland, Ont.

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Can. Fairbanks-Morse Co., Montreal
Cleveland Twist Drill Co., Cleveland
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.

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Petrie, Ltd., H. W., Toronto.

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Quaker City Rubber Co., Philadelphia, Pa
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Pratt & Whitney Co., Dundas, Ont.

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MEASURING TAPES AND RULES
Chesterman & Co., Jas., Sheffield, Eng.

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General Osborne (Can.), Ltd., Montreal

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See Chemists.

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Atkins & Co., E. C., Hamilton, Ont
Lyman Tube & Supply Co., Montreal, Que.

METAL SAWS
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Hoefer Mfg. Co., Freeport, Ill.
Lyman Tube & Supply Co., Montreal, Que.

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Hoyt Metal Co., Toronto, Ont.
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Standard Machy. & Supplies, Montreal

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General Combustion Co., Ltd., Montreal, Que.

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Petrie, Ltd., H. W., Toronto.

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MILLS, SAND
Frost Mfg. Co., Chicago, Ill.

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Alexander Fleck, Ltd., Ottawa.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

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Ackworthie Ltd., J., Birmingham, Eng.
Garlock-Walker Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee Wis.
Strelinger, Chas. A. Co., Windsor, Ont.

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Bertram & Sons Co., John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co. Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Hendey Mach. Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.

MILLING MACHINES, AUTOMATIC
Sifton Mach. Tool Co., Bridgeport, Conn
Brown & Sharpe Mfg. Co., Providence, R.I.
Betts Machine Co., Rochester, N.Y.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.

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Butterfield & Co., Inc., Rock Island, Que.
Cleveland Milling Machine Co., Cleveland
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
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Kearney & Trecker Co., Milwaukee, Wis.
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Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

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Bristol Machine Tool Co., Bristol, Conn.

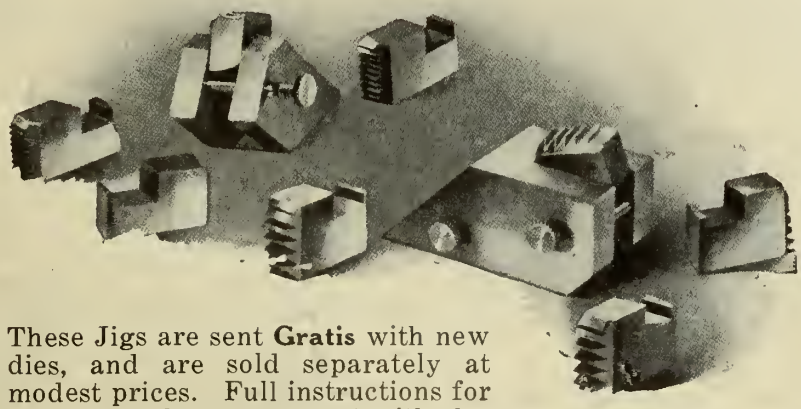
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United States Mach. Tool Co., Cincinnati
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Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.
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Canada Machinery Corp., Galt, Ont.
Cochrane-Bly Co., Rochester, N.Y., U.S.A
Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Herbert, Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
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Gooley & Edlund, Ine., Cortland, N.Y.
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Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
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Standard Equipment & Tool Wks., Montreal, P.Q.
Strelinger, Chas. A. Co., Windsor, Ont.

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Petrie, Ltd., H. W., Toronto.
Williams Mchy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Frost Mfg. Co., Chicago, Ill.

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Garlock-Walker Machy. Co., Toronto, Ont.

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Garlock-Walker Machy. Co., Toronto, Ont.
Toronto.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Sturtevant Co., B. F., Galt, Ont.
Volta Mfg. Co., Welland, Ont.
Williams Mach'y Co., A. R., Toronto.

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NICHROME CASTINGS

Can. Driver-Harris Co., Ltd., Walkerville.

NICKEL

Pilot Steel & Tool Co., Montreal, Que.

NICKEL STEEL

See Steel.

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National-Acme Co., Cleveland, Ohio.
Wilkinson & Kompass, Hamilton.

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NUT FACING AND BOLT SHAVING MACHINES

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National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Victor Tool Co., Waynesboro, Pa.

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Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

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Can. Fairbanks-Morse Co., Montreal.

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Can. Link-Belt Co., Toronto, Ont.
Gutta Percha & Rubber, Ltd., Toronto.
MacKinnon Steel Co., Sherbrooke, Que

PARTITIONS, WIRE

See Guards

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Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

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Landis Machine Co., Waynesboro, Pa.
McDougall Co., R., Galt.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

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Wells Bros. Co. of Canada, Galt, Ont
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

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Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE CUTTERS AND REAMERS

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Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. of Canada, Galt, Ont.

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Strelinger, Chas. A. Co., Windsor, Ont.
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Wells Bros. of Canada, Galt, Ont.

PIPE WRENCHES

Greenfield Tap & Die Corp., Greenfield.
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Can. Fairbanks-Morse Co., Montreal
Foss Mchy. & S'ply Co., G. F., Montreal
Gardner & Son, Robt., Montreal.
Garlock-Walker Machinery Co. Toronto
Garvin Machine Co., New York.
Herbert Ltd., Alfred, Toronto, Ont.
Morton Mfg. Co., Muskegon Heights, Mich
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Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
Standard Equipment & Tool Wks., Montreal.

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Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
Herbert, Ltd., Alfred, Toronto, Ont.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William, Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co. Ltd., A. R., Montreal

PLANER-SHAPER, COMBINED OPEN SIDE

Petrie, Ltd., H. W., Toronto.

PLANING MILL EXHAUSTERS

Can. Blower & Forge Co., Kitchener, Ont.
MacGovern & Co., Montreal, Que.
Niles-Bement-Pond Co., New York.
Sturtevant Co., B. F., Galt, Ont.

PLATES, Q.M., SHEARED AND CHEQUERED

Peckovers, Ltd., Toronto, Ont.

PLIERS

Aikenhead Hardware Co., Toronto.
Rice Lewis & Son, Toronto, Ont.

PNEUMATIC CYLINDERS

Holden Co., Ltd., Montreal, Que.

PNEUMATIC EQUIPMENT

Strelinger Co., C. A., Windsor, Ont.

PNEUMATIC TOOLS

Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland P'matic Tool Co., Can., Toronto.
Curtis Pneumatic Machy. Co., St. Louis.
Garlock-Walker Machy. Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Chicago.
Int. Mach. & Supply Co., Ltd., Montreal.
Strelinger, Chas. A. Co., Windsor, Ont.

POWER CRANES, HAND

MacKinnon Steel Co., Sherbrooke, Que.

POLISHING MACHINES

Ackworthie Ltd., J., Birmingham, Eng.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.

POLISHING PLATES

Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. of Canada, Galt, Ont.

POTS AND KETTLES, CAST STEEL

Elec. Steel & Metals, Welland, Ont.

POWER HOUSE CONVEYORS

Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

PORTABLE MACHINERY

Haskins & Co., R. C., Chicago, Ill.

POWER TRANSMISSION MCHY.

Canadian Link-Belt Co., Ltd., Toronto.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Petrie, Ltd., H. W., Toronto.

PRECISION MACHINES

Herbert Ltd., Alfred, Toronto, Ont.

PRESSED STEEL PARTS

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PRESSERS, ARBOR

Atlas Press Co., Kalamazoo, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
Lourie Manufacturing Co., Springfield, Ill.

PRESSES, BROACHING, FORGING AND FLANGING

Atlas Press Co., Kalamazoo, Mich.
Bliss Co., E. W., Brooklyn, N.Y.
Dom. Steel Products Co., Ltd., Brantford.
Eastern Production Co., Detroit, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, CAM, TOGGLE, EYELET

Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn, N.Y.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.

PRESSES, FILTER

Perrin, Ltd., William R., Toronto.

PRESSES, PNEUMATIC

Dom. Steel Products Co., Ltd., Brantford.
Eastern Production Co., Detroit, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Toledo Machine & Tool Co., Toledo.

PRESSES, DROP AND FORGING

Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co. Ltd., Hamilton.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co, Toledo.

PRESSES, HYDRAULIC

Bertram & Sons Co., John, Dundas.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke.
Dom. Steel Products Co., Ltd., Brantford.
Eastern Production Co., Detroit, Mich.
Lourie Manufacturing Co., Springfield, Ill.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co, Toledo.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Williams Machy. Co., A. R., Toronto.

PRESSES, HYDRAULIC, HORIZONTAL

Eastern Production Co., Detroit, Mich.

PRESSES, HYDRAULIC, VERTICAL

Eastern Production Co., Detroit, Mich.

PRESSES, HYDRO-PNEUMATIC

Eastern Production Co., Detroit, Mich.

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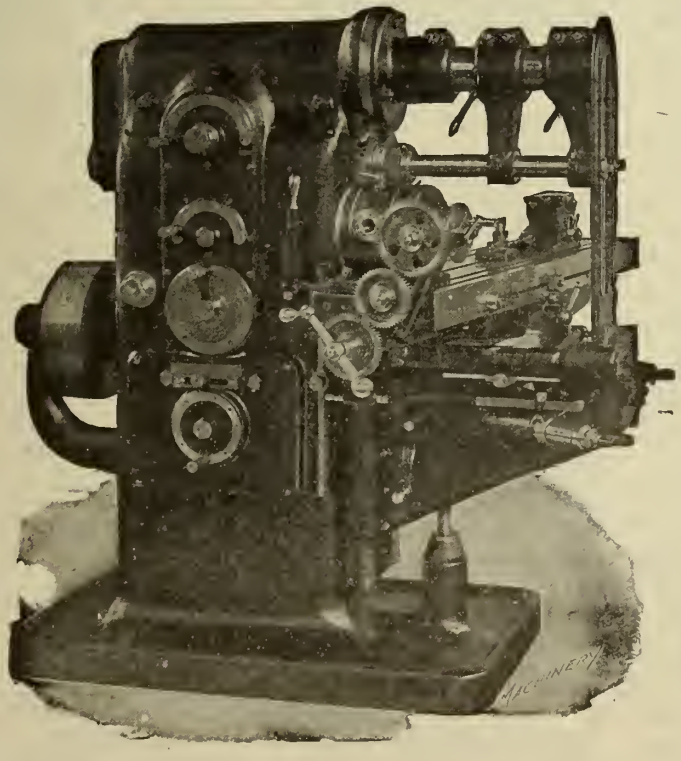
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If interested tear out this page and place with letters to be answered.

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Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Machy. Co., A. R., Toronto.

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Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.
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Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

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Bliss Co., E. W., Brooklyn, N.Y.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.

PRESSES, TIRE
Can. Ingersoll-Rand Co., Ltd., Sherbrooke.

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Bliss Co., E. W., Brooklyn, N.Y.
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Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.

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Lyman Tube & Supply Co., Montreal, Que

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American Pulley Co., Philadelphia.
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Barnard Industrial Co., Fortierville, Que.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Diamond State Fibre Co., Bridgeport, Pa.
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Kennedy & Sons, Ltd., W., Owen Sound.
Positive Clutch & Pulley Works Ltd., Toronto.
Petrie, Ltd., H. W., Toronto.

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American Pulley Co., Philadelphia, Pa.

PULLEYS, FRICTION, CLUTCH
American Pulley Co., Philadelphia, Pa.
Baird Machine Co., Bridgeport, Conn.
Barnard Industrial Co., A., Fortierville, Q
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mch. Co., Manchester, Ct.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Jones & Glassco, Montreal.
Positive Clutch & Pulley Works, Toronto.
Petrie, Ltd., H. W., Toronto.

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Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

PUMPS, AIR LIFT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Holden Co., Ltd., Montreal, Que.

PUMPS, BOILER FEED
Can. Ingersoll-Rand Co., Ltd. Sherbrooke,

PUMPS, CENTRIFUGAL
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Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Darling Bros., Ltd., Montreal, Que.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Pratt & Whitney Co., Dundas, Ont.
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Globe Engineering Co., Hamilton, Ont.

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PUMPS, HYDRAULIC
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Garlock-Walker Machinery Co., Toronto.
Darling Bros., Ltd., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, RETURN AIR
Can. Ingersoll-Rand Co. Ltd., Sherbrooke,

PUMPS, SPECIAL
Elec. Steel & Metals, Welland, Ont.

PUMPS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, KEROSENE, OIL, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, LUBRICANT, OIL, WATER
Darling Bros., Ltd., Montreal, Que.
Trabern Pump Co., Rockford, Ill.

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General Combustion Co., Ltd., Montreal, Que.

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Can. Blower & Forge Co., Kitchener, Ont.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Gardner & Son, Robert, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Marshall, Son & Blunney, Toronto.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams Mchy Co., A. R., Toronto, Ont.

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Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Buffalo, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

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Bertrams & Sons, John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton, Ont.
Garlock-Walker Mach'y. Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHES, HAND
Niles-Bement-Pond Co., New York.

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Shore Instrument & Mfg. Co., New York.
Taylor Instrument Co., Rochester, N.Y.

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Niles-Bement-Pond Co., New York.

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Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

RASPS
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Marshall, Son & Bunney, Toronto.

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REAMERS, ADJUSTABLE
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Cleveland Twist Drill Co., Cleveland.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.
J. A. M. Taylor, 118 Stair Bldg., Toronto
Wells Bros. of Can., Galt, Ont

REAMERS, BRIDGE, EXPANDING AND HIGH SPEED
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Aikenhead Hardware Co., Toronto
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Gisholt Machine Co., Madison, Wis.
Lyman Tube & Supply Co., Montreal, Que
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Samuel Osborne, Ltd., Montreal, P.Q.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

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Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, CHUCKING
Ackworthie Ltd., J., Birmingham, Eng.
Atkins & Co., Ltd., Wm., Sheffield, Eng
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. of Canada, Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, HAND
Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Inc., Rock Island Que.
Greenfield Tap & Die Corp., Greenfield.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

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Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Morrow Screw & Nut Co., John, Ingersoll
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

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REAMING MACHINES, PNEUMATIC
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Holden Co., Ltd., Montreal, Que.

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Gisholt Machine Co., Madison, Wis.
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REGULATORS, PRESSURE, TEMPERATURE
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REPAIR WORK, ALL KINDS
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Parmenter & Bulloch Co., Gananoque.
Rice, Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.

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Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co. Toronto.
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High-Speed Hammer Co., Rochester.
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Strelinger Co., C. A., Windsor, Ont.

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Holden Co., Ltd. Montreal, Que.

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G. F. Foss Mchy & Sply. Co., Montreal

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Can. Driver-Harris Co., Ltd., Walkerville

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Can. Link-Belt Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que
Renold of Canada Ltd., Montreal.

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Can. Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo, O.

ROLLS CRUSHING
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ROLLS AND TABLES
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Elec. Steel & Metals, Welland, Ont.

ROOFING
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ROPE, GALV. MONEL METAL, BRONZE, TILLER AND SASH CORD
Can. Driver-Harris Co., Ltd., Walkerville

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Manhattan Machine & Tool Co., Grand Rapids, Mich.

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Mesta Machine Co., Pittsburgh, Pa.

ROLL LATHES
Mesta Machine Co., Pittsburgh, Pa.

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Manhattan Machine & Tool Co., Grand Rapids, Mich.

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Can. Link-Belt Co., Toronto.

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Dom. Steel Products Co., Ltd., Brantford.
Can. Link-Belt Co., Toronto.

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford.

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

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Rice, Lewis & Son, Toronto.
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Petrie, Ltd., H. W., Toronto.

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SAND MIXING MACHINERY
Frost Mfg. Co., Chicago, Ill.

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Hamilton Co., Ltd., Wm., Peterborough, Ont.
A. R. Williams Machy. Co., Toronto
Williams Mchy Co., A. R., Toronto, Ont.

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Cochrane-Bly Co., Rochester, N.Y., U.S.A.
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Marshal, Son & Bunney, Toronto
Simonds Mfg. Co., Fitchburgh, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

SAWS, HACK (See Hack Saws)

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Atkins & Co., E. C., Hamilton, Ont
Clemson Bros. Inc., Hamilton, Ont.

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Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Can., Galt, Ont.

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Atkins & Co., E. C., Hamilton, Ont.

SAWS — HIGH-SPEED FRICTION
Atkins & Co., E. C., Hamilton, Ont.

SAWS — PATTERN SHOP
Atkins & Co., E. C., Hamilton, Ont.

SAWS — SWING
Atkins & Co., E. C., Hamilton, Ont.

SCLEROSCOPES
Shore Instrument & Mfg. Co., New York

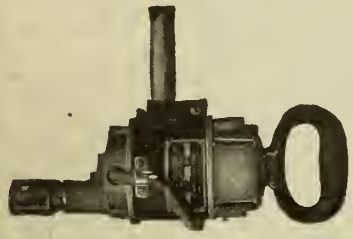
SCREENING MACHINERY
Can. Link-Belt Co., Toronto.

SCREW EXTRACTORS
Cleveland Twist Drill Co., Cleveland.

SCREW MACHINES, HAND, AUTOMATIC
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Can. Fairbanks-Morse Co., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Ltd., Toronto
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
Herbert, Ltd., Alfred, Toronto, Ont.
A. B. Jardine & Co., Hespeler.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
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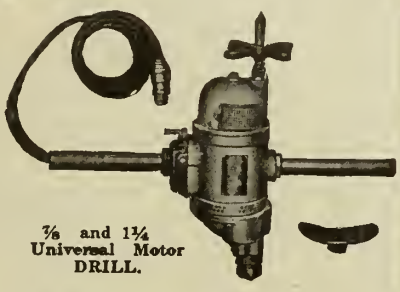
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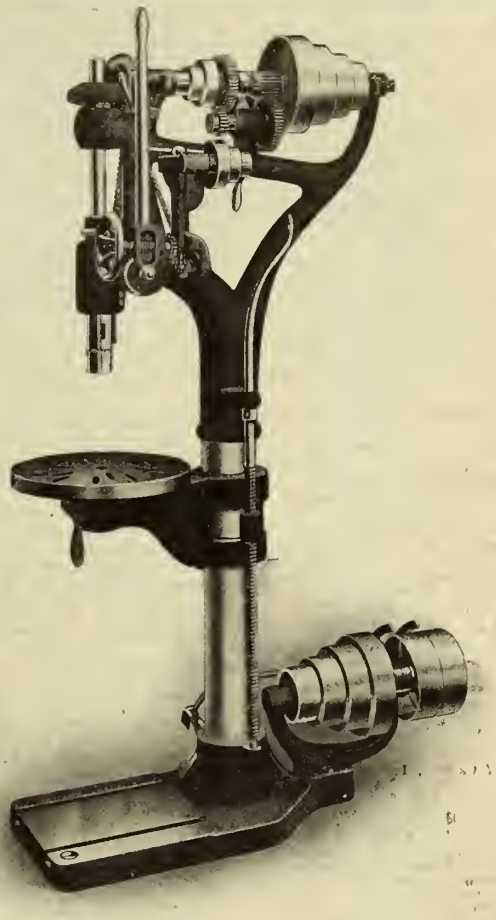
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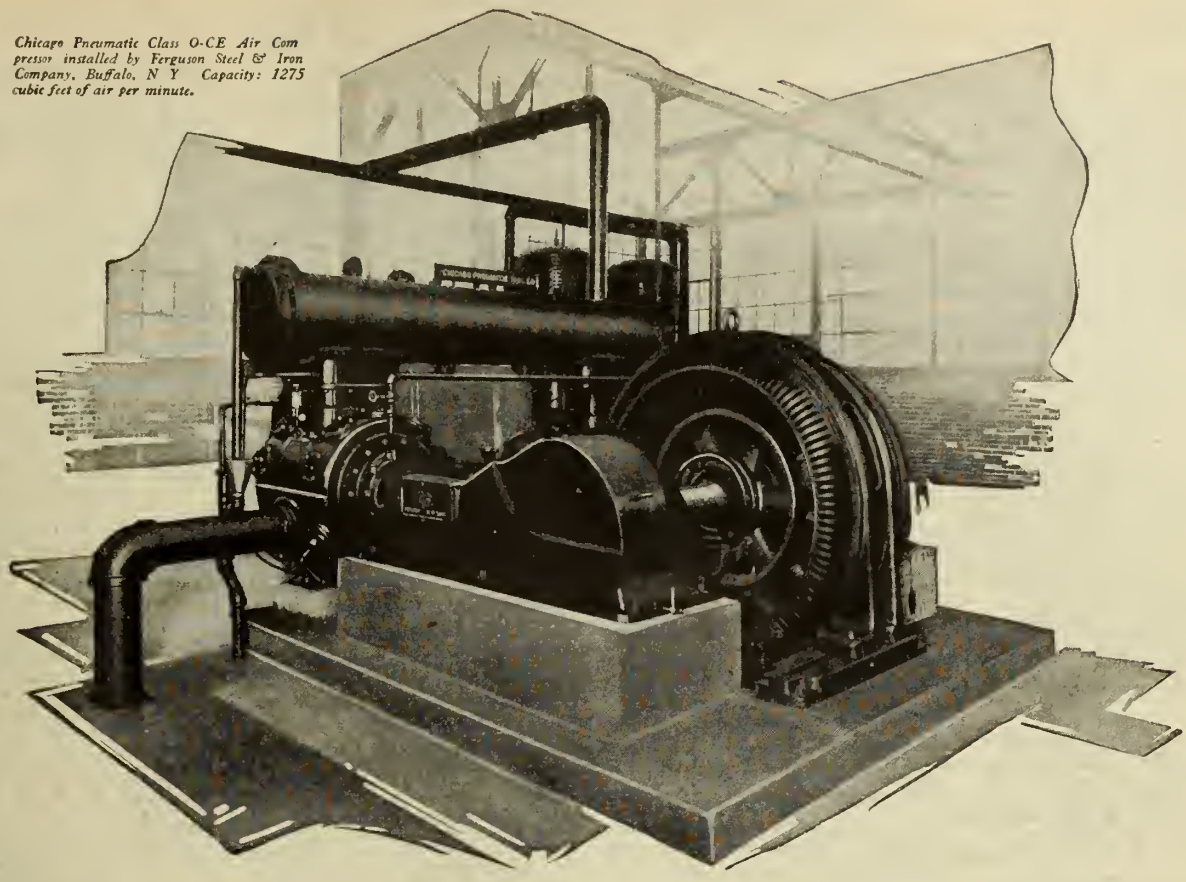
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Published by

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Builders of Machine Tools since 1865

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The other day the vice-president of a New England manufacturing concern rang us up on the 'phone. He said, "I'm at the Biltmore—got a rush grinding job—where's a good machine shop in New York?"

Well, we told him to bring it along down to us. He did—we did the work in a jiffy, but that isn't the point.

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It would be interesting to call the roll—

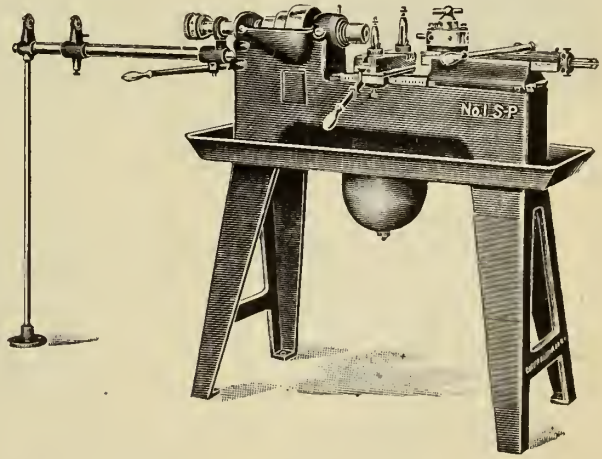
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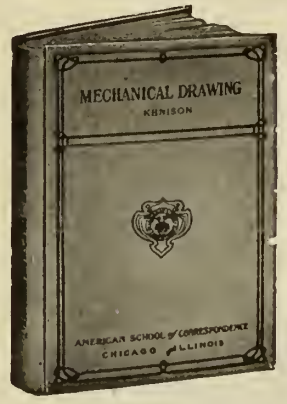
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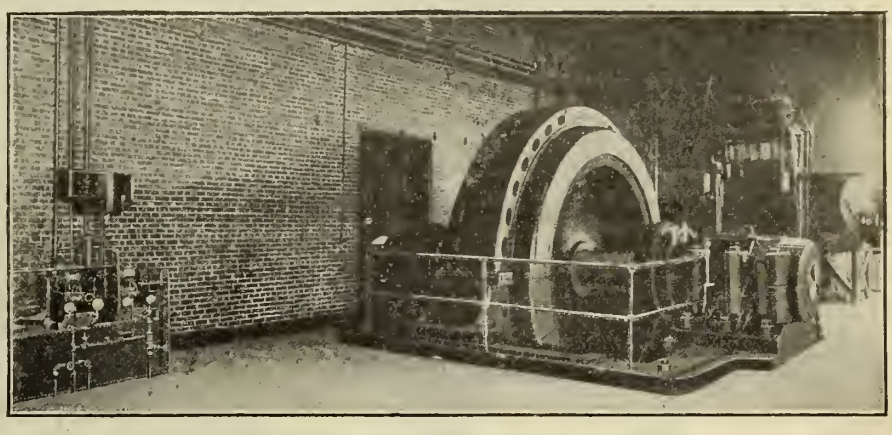
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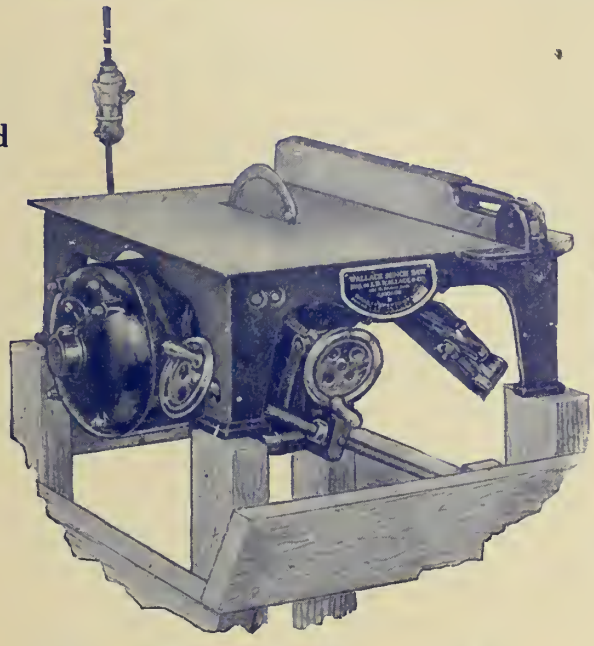
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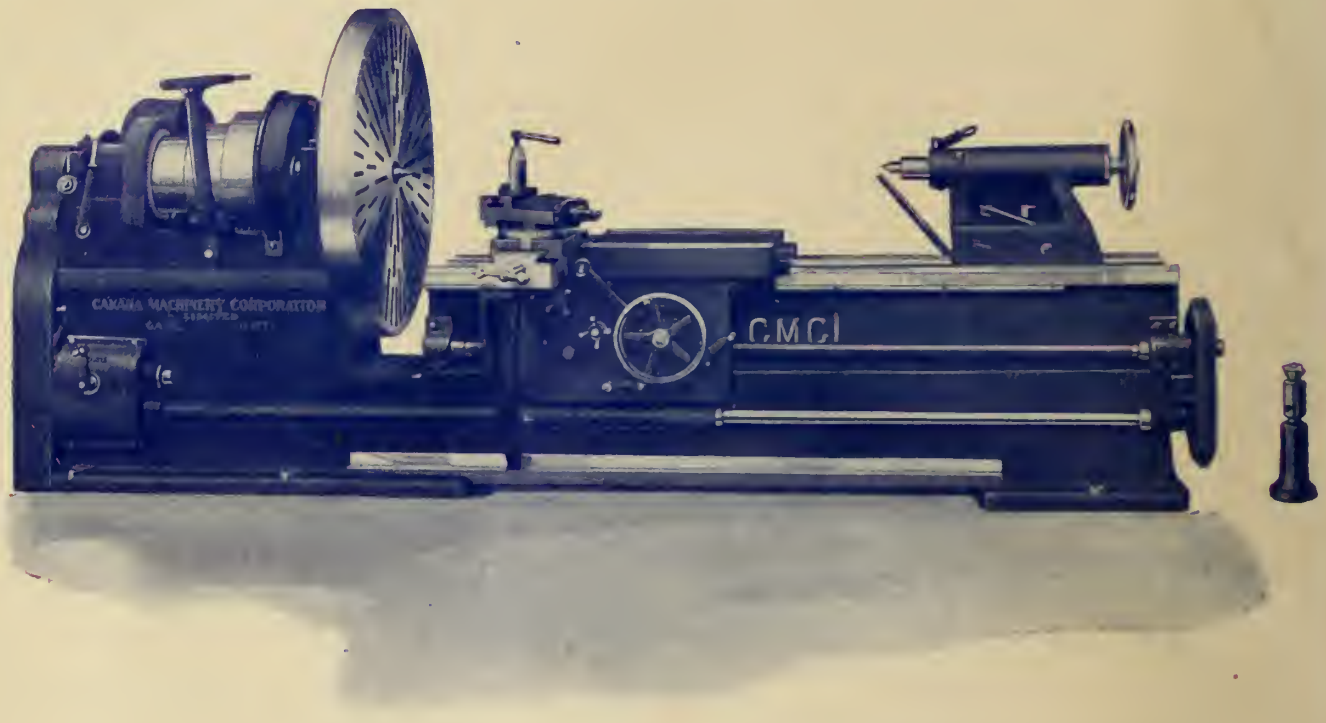
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The BERTRAM Page

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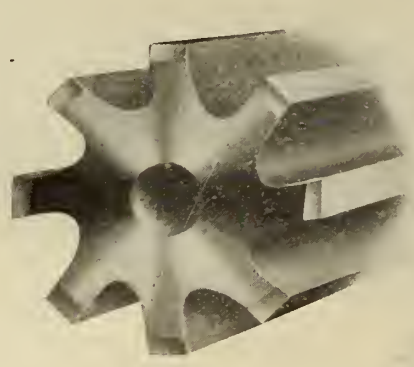


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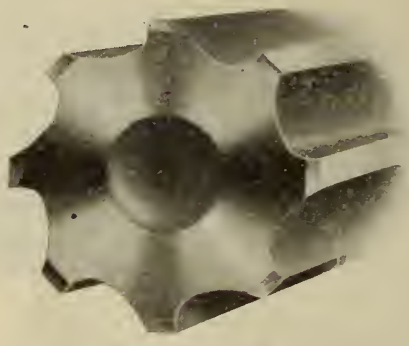
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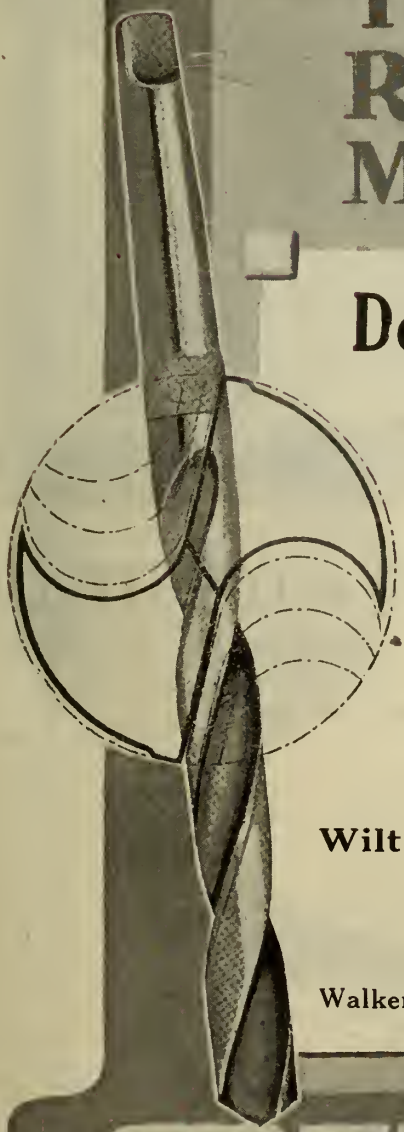
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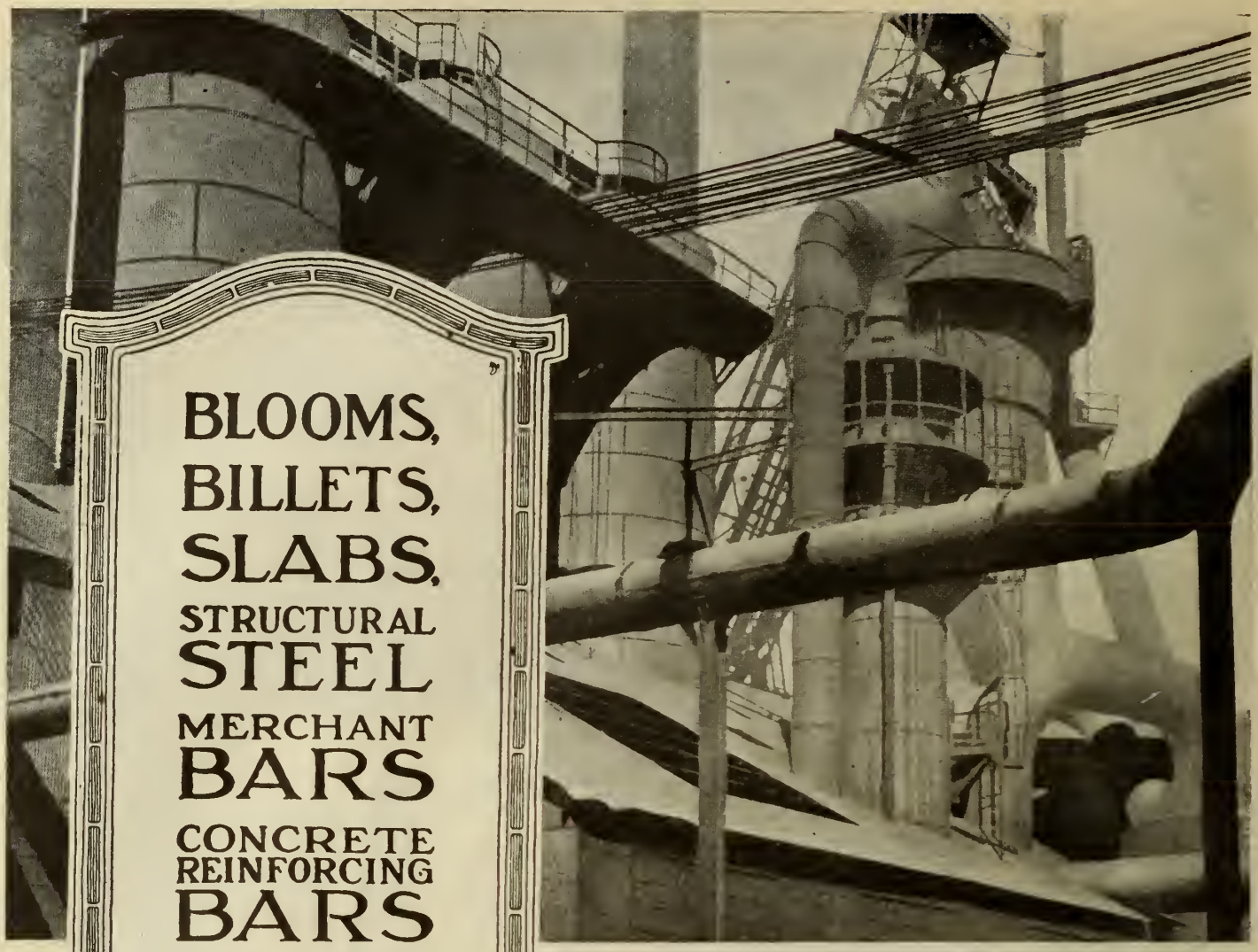
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The Gear Shaper Way

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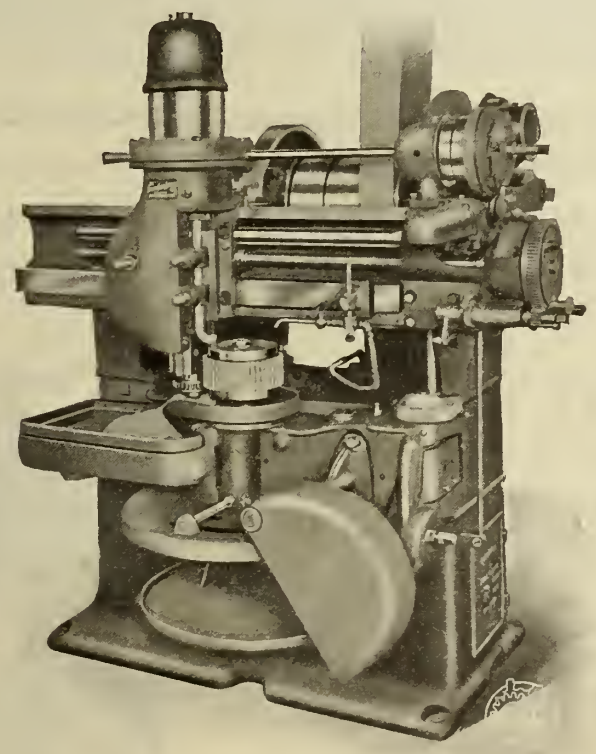
When the Gear Shaper was originally designed, the question of "IF" was taken into consideration and every possible means known to mechanical engineering was employed to eliminate the "IFS" from gear cutting.

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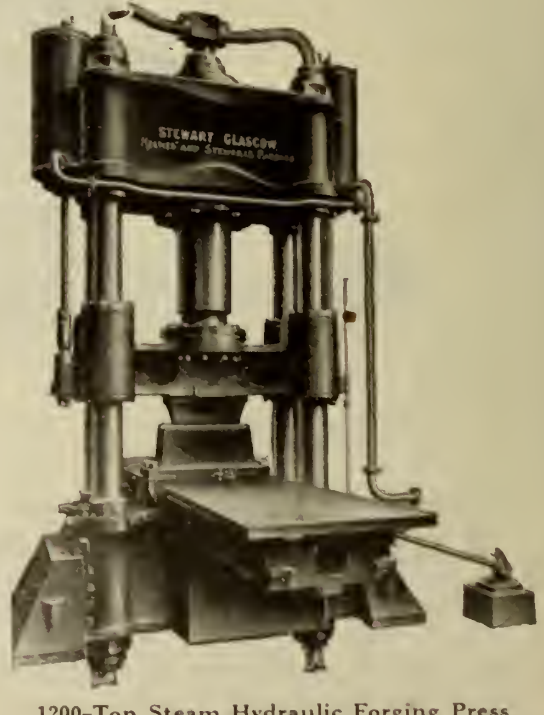
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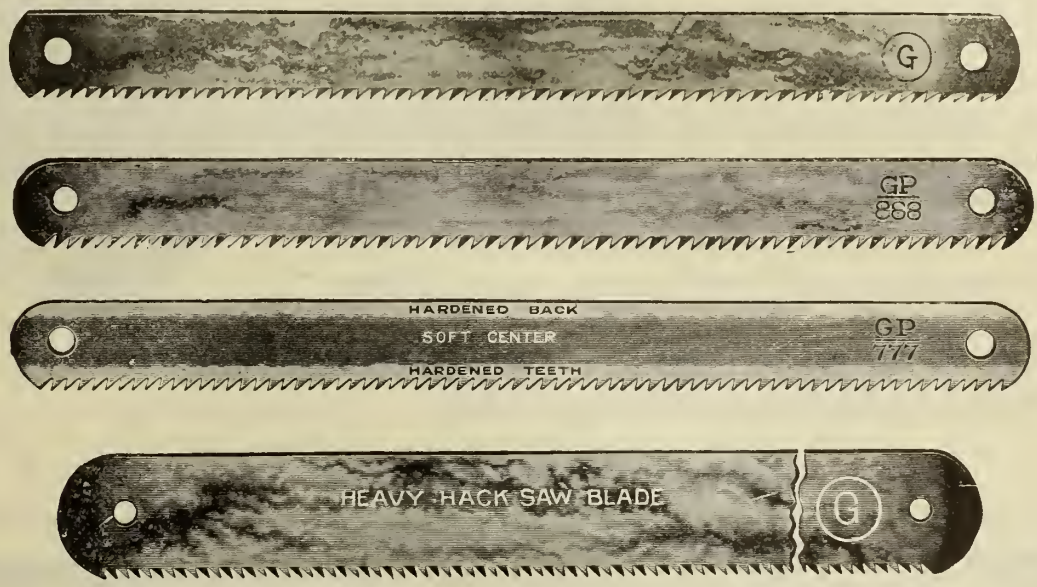
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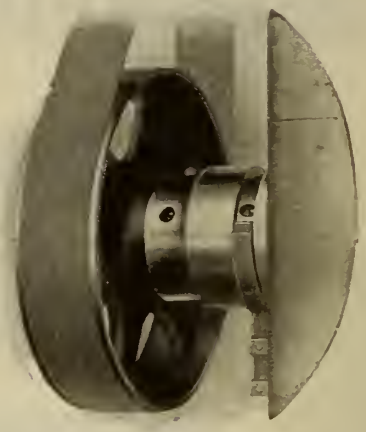
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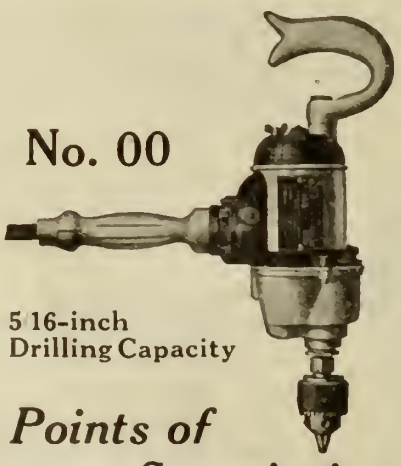
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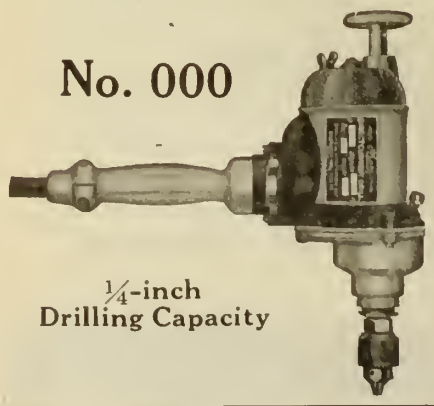
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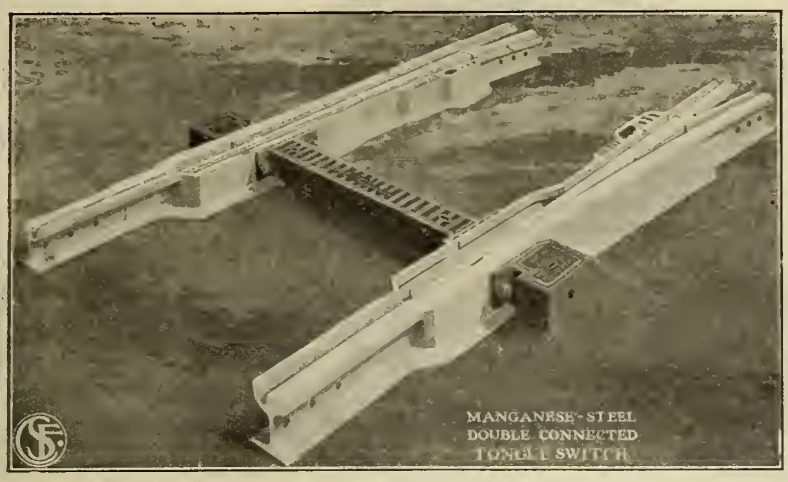
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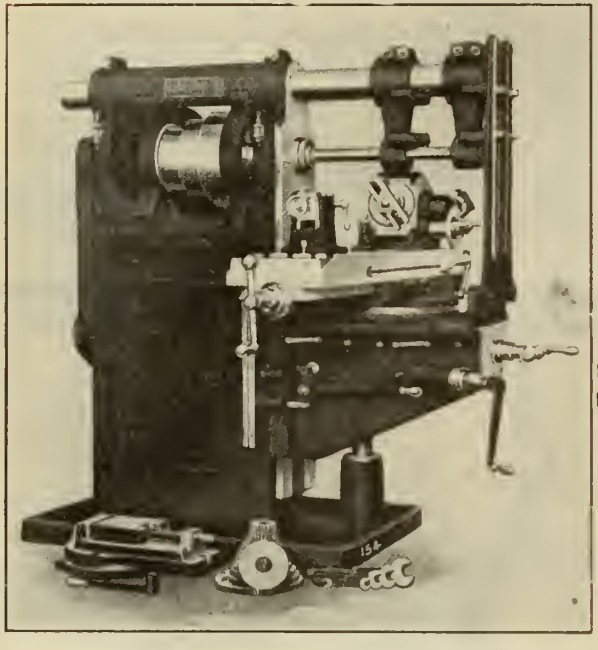
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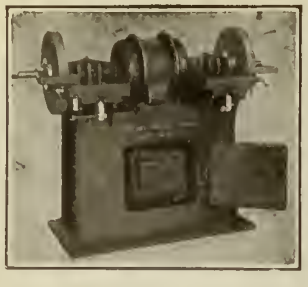
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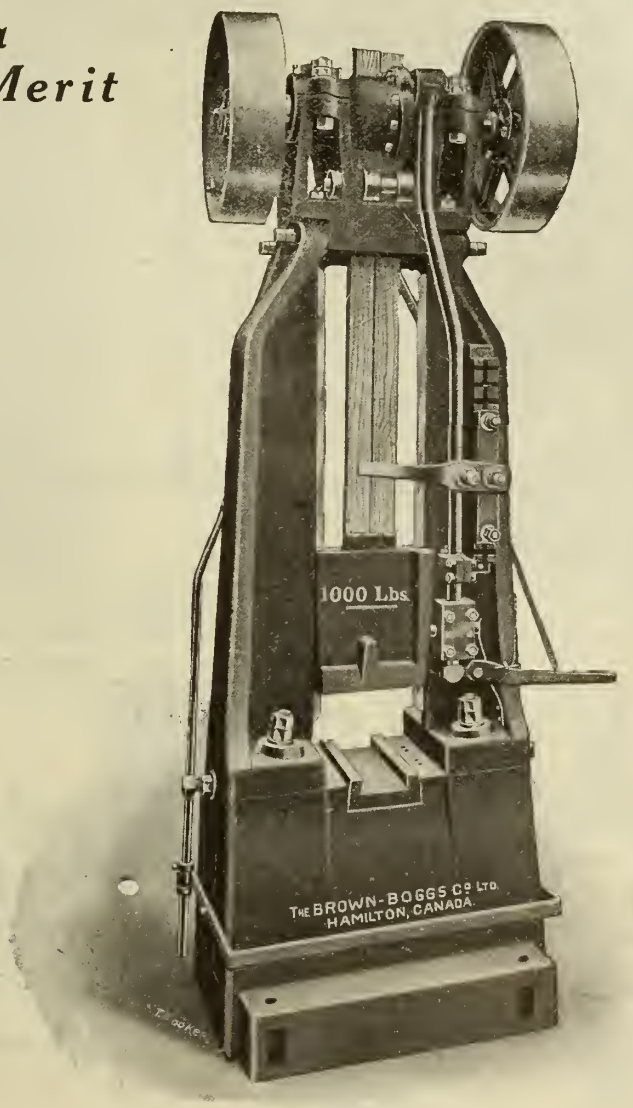
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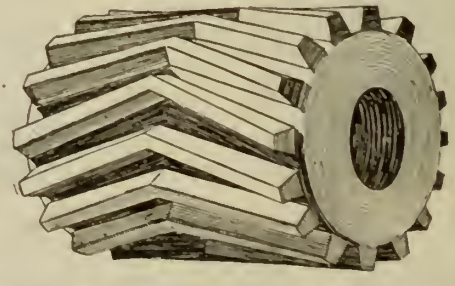
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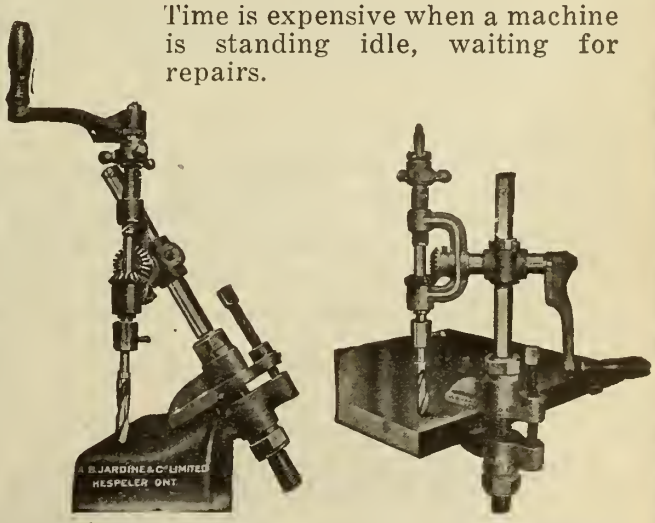
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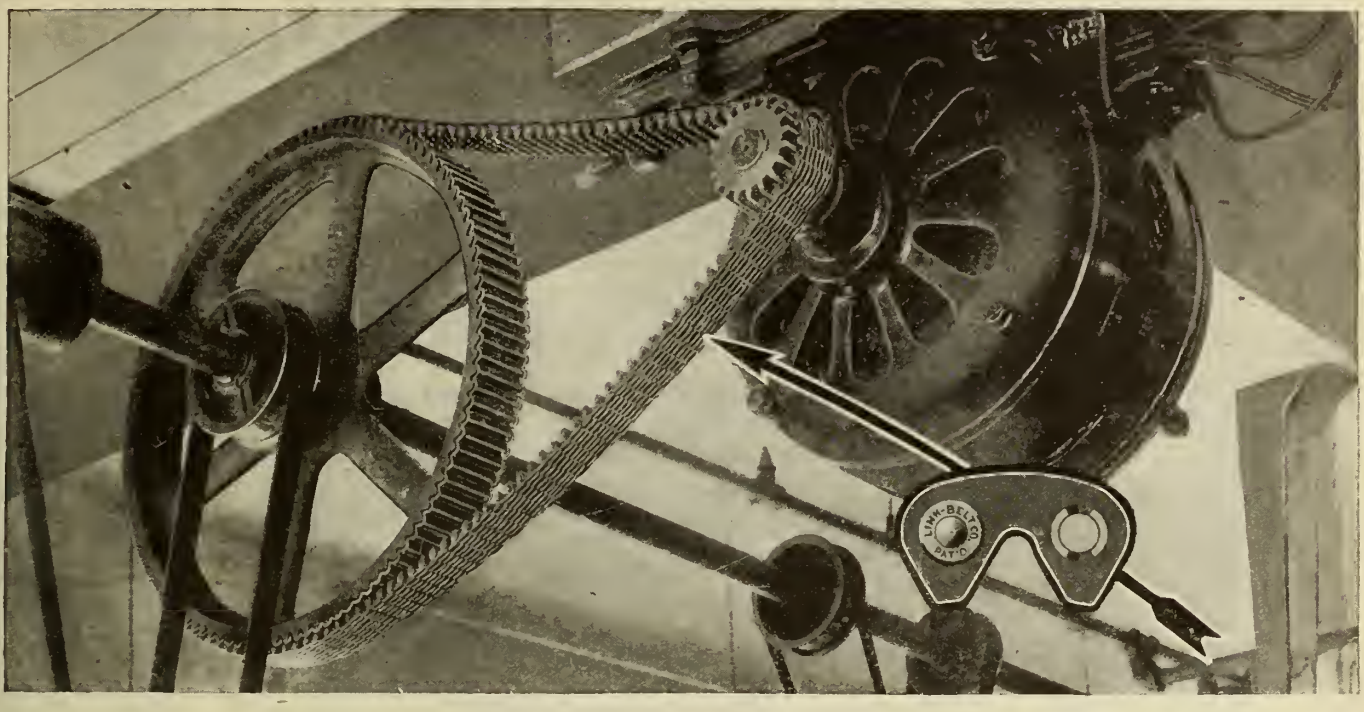
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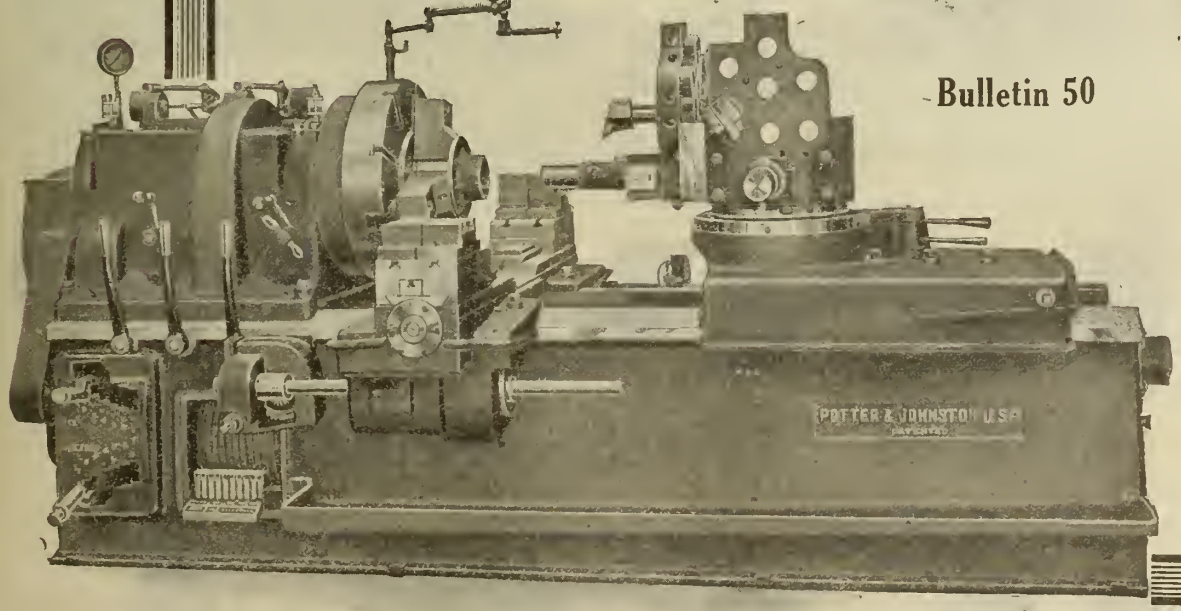
Swing Over Bed	35″
Swing Over Cross Slide	24″
Travel of Cross Slide (Front and Rear Separate)	10″
Number of Turret Faces	4
Diameter of Holes in Turret	3″
Depth of Holes in Turret	4½″
Distance from Centre of Turret Hole to Top of Turret Slide	5″
Maximum Turret Slide Travel	28″
Turret Feed	28″
Length of Turret Slide Travel Which Permits of Supporting or Piloting Turret Boring Tools	13½
Turret Slide Adjustment	13
Front Spindle Bearing	7¾″ Dia. x 7″ Long
Rear Spindle Bearing	7-5/16″ x 5″ Long
Dia. of Hole Through Spindle	6″
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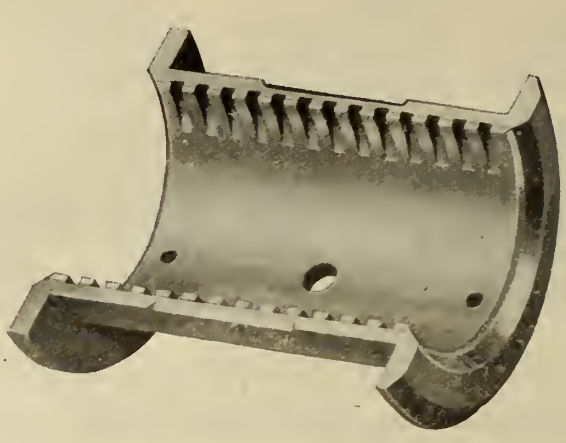
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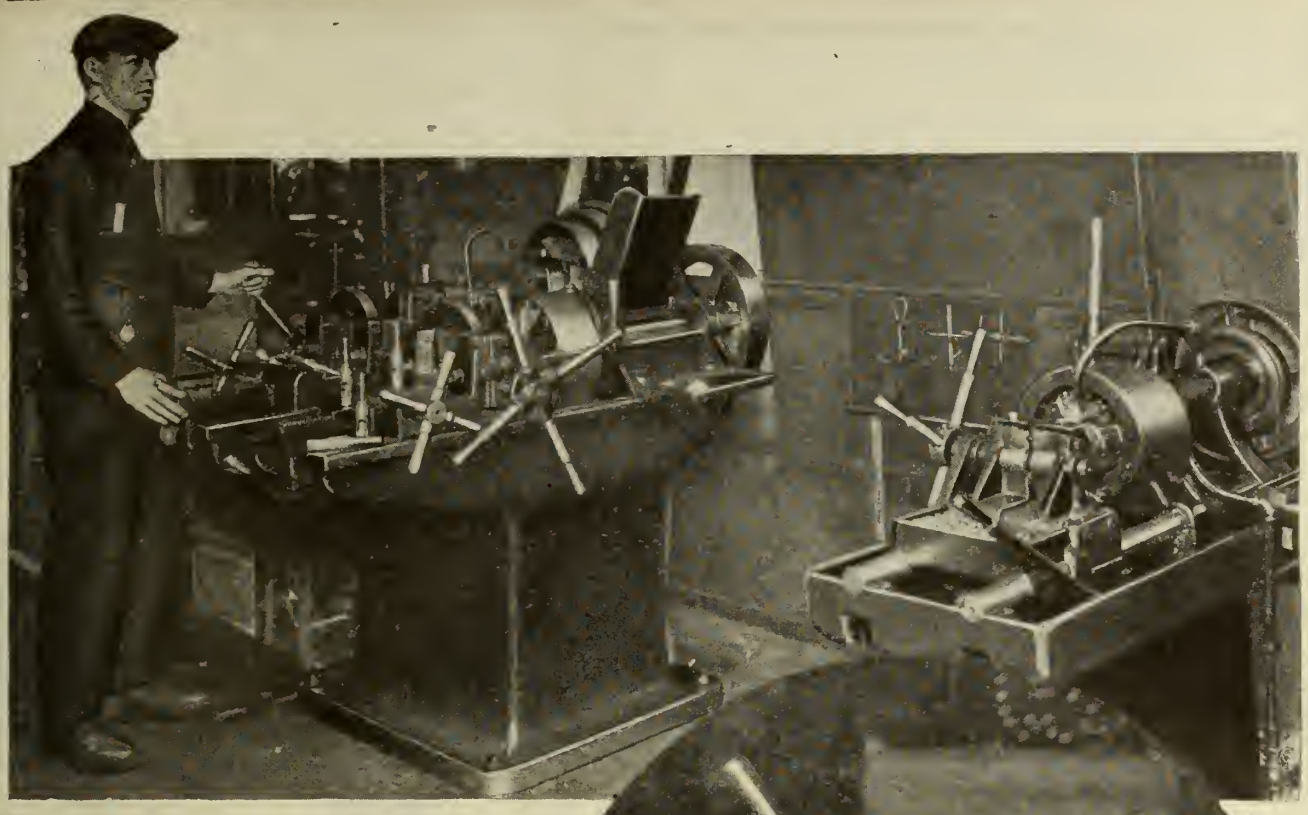
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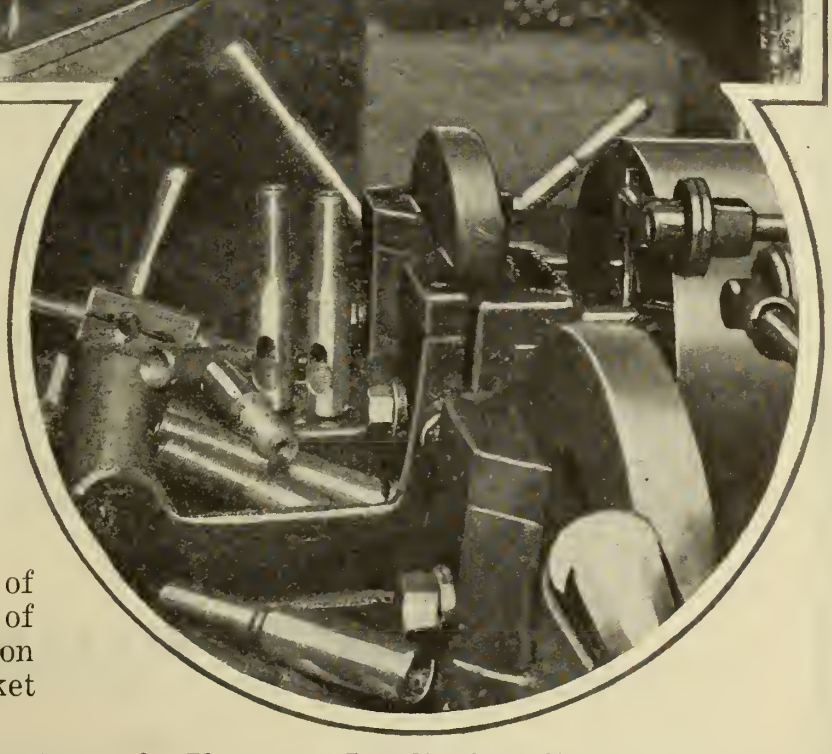
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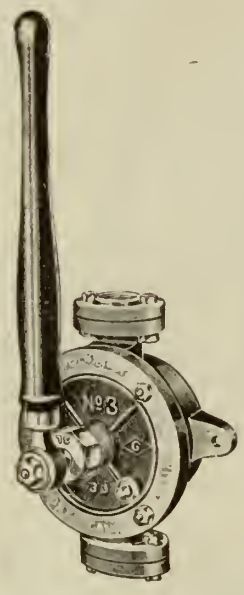
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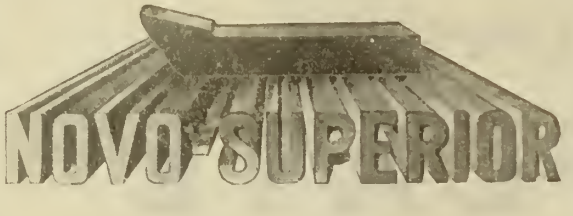
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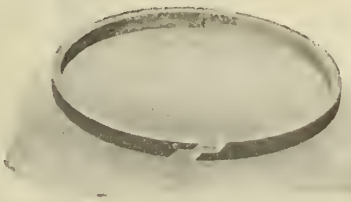
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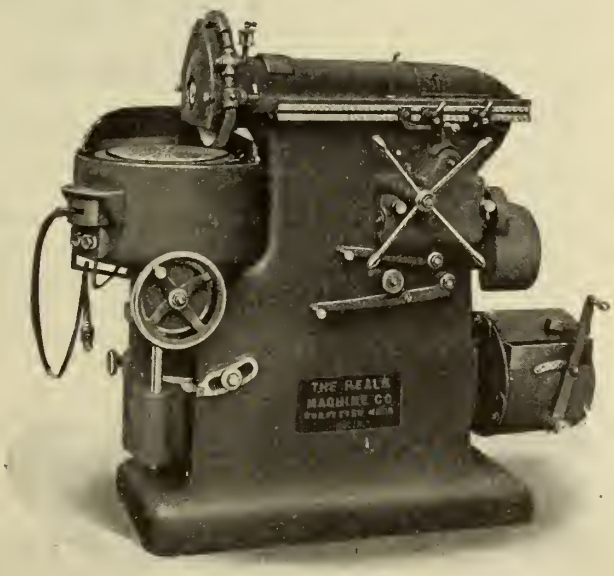
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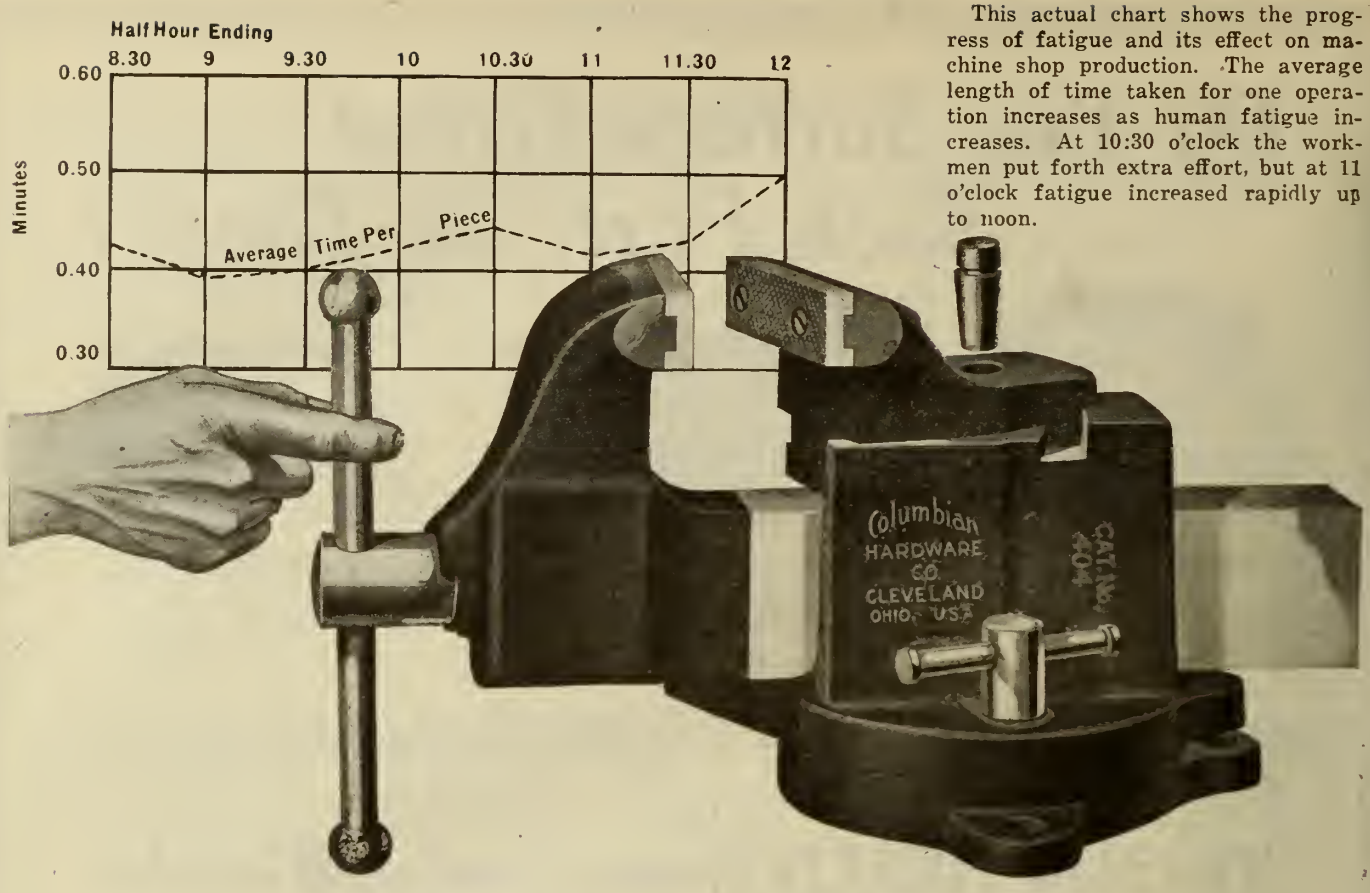
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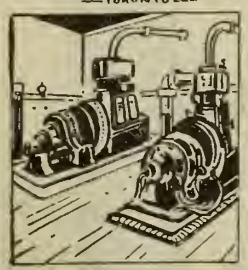
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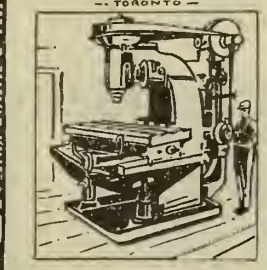
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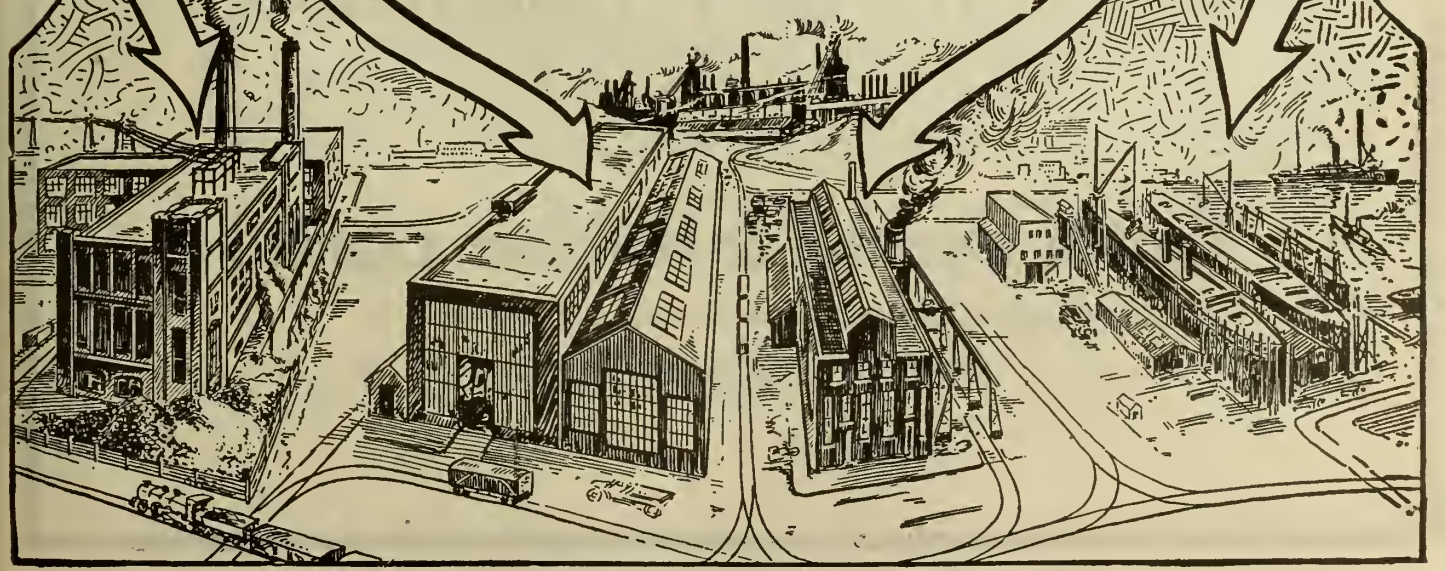
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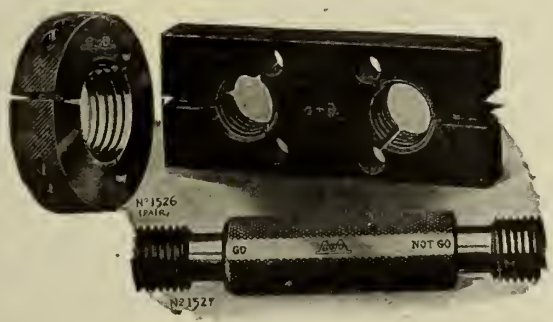
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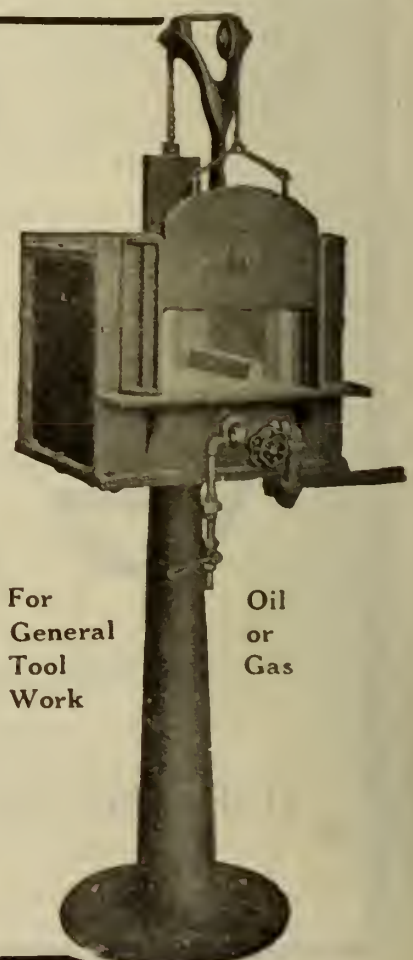
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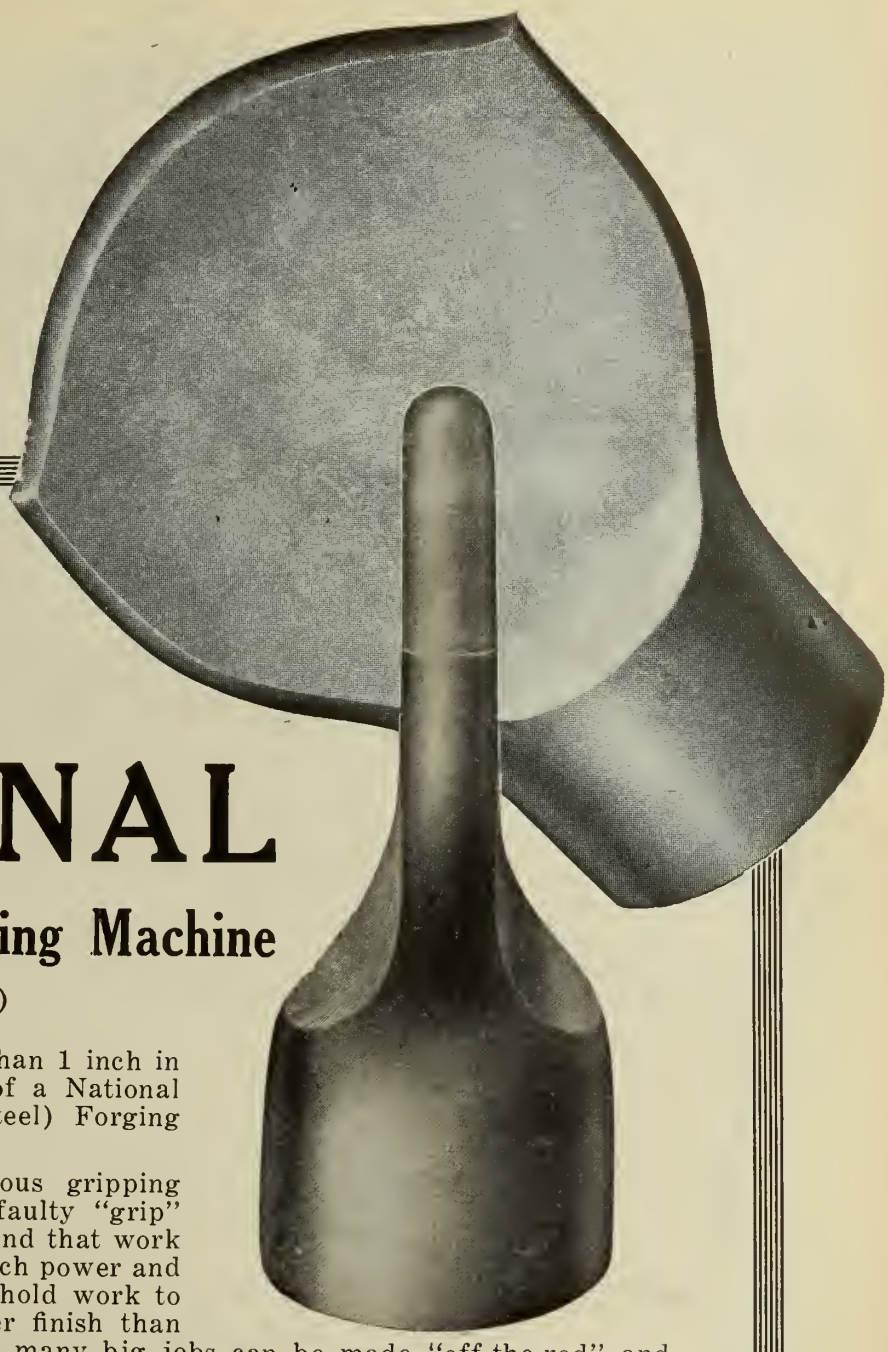
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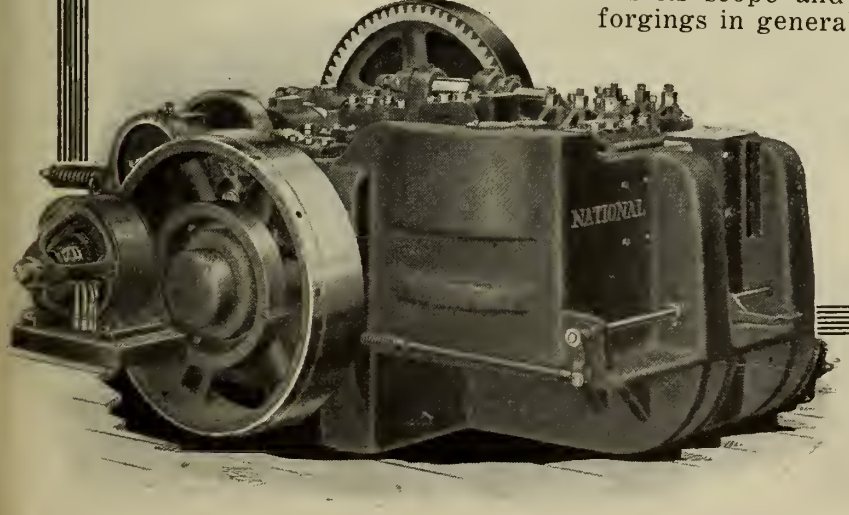
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A 4-inch bar flattened to less than 1 inch in one squeeze in the grip dies of a National 5-inch Heavy Pattern (All Steel) Forging Machine.

This demonstrates the enormous gripping power, assures the user that faulty "grip" does not exist in the National, and that work cannot slip in the Dies. With such power and rigidity in the "grip" you can hold work to closer limits and secure better finish than ever possible heretofore. Also many big jobs can be made "off-the-rod" and sheared in the Dies.

This added power makes the NATIONAL a universal Forging Machine, broadens its scope and simplifies the production of forgings in general.



THE NATIONAL MACHINERY COMPANY

Tiffin, Ohio, U.S.A.

Canadian Representative:
H. W. PETRIE, LTD.,
Toronto - - Montreal

ARE YOU RECEIVING NATIONAL FORGING MACHINE TALKS?



MACHINERY AND SUPPLIES

All Your Requirements Promptly Filled

The Petrie policy of Efficiency in Service is one of the sterling qualities that have built up and sustained the public confidence in H. W. Petrie Limited for fifty years.

We have the facilities to handle a contract of any size in the quickest possible time and at most reasonable prices. Get Petrie habit when ordering.

Petrie Service does not stop with the prompt delivery of dependable Machinery and Supplies.

We have a staff of experts which we have developed and retained to give advice on Machinery problems. Consult them freely. You'll find the advice valuable and authoritative as well as prompt.

Always remember that PETRIE signifies MACHINERY and SUPPLIES, QUALITY and FAIR DEALING.

Canada's Dependable Machinery and Supply House

PETRIE


"They've Got 'em in Stock!"
You can tell he buys from a man who sells
CLEVELAND
THE CLEVELAND TWIST DRILL CO., Cleveland, New York, Chicago
Agents for Europe, CLEVELAND TWIST DRILL CO. (GREAT BRITAIN), Ltd., 36-37 Upper Thames St., London E.C.4.

MADE
IN CANADA

MALLEABLE AND CAST IRON PIPE FITTINGS

Annual Capacity
6000 Tons

Quality Products

Prompt Service

Brand Pipe Fittings, Screwed or Flanged, Black or Galvanized.

We are equipped to make the general run of malleable and grey iron castings for machinery manufacturers, agricultural implements, automobiles and specialties.

Cast Iron Fittings
stamped with our trade-mark mean fittings made with iron of high tensile strength — proper proportions and correct tappings.

RECESSED DRAINAGE FITTINGS

Malleable Fittings
of our brand mean fittings made of *Air Furnace Refined Iron*, reamed and tapped to gauge with perfect threads.

A trial of our pipe fittings will prove the quality of service they give.

International Malleable Iron Company, Limited
GUELPH, CANADA

If interested tear out this page and place with letters to be answered.



Pat. No. 200576

RIDSDALE
REINFORCED BEARINGS

Patented in Great Britain and U.S.A.

Will End Your Bearing Troubles!

WHY use bearings which are a continual source of worry and expense when you can have efficient, care-free service by using Ridsdale Reinforcement?

Ridsdale Reinforcement put into any bearing and anchored by even the cheapest grade of babbitt assures you of a bearing of great toughness and flexibility and an excellent conductor of heat, capable of giving a service many times superior to that of any babbitt made and free from hard points.

From actual tests made in bearings when all other means had failed (at considerable expense) Ridsdale Reinforced Bearings gave entirely satisfactory service, in fact, the results proved astounding and almost eliminated the cost.

Extract from letter from a railway company using Ridsdale Reinforcement:

"By using your bearing we save ourselves a great deal of work and money."

Other particulars given upon request.

We are manufacturers of

Architectural Iron Work, Dies, etc.	Medium and Small Rubber Molds
Machine Vice	Special Machinery
Flax Machinery	Tanks (Welded)
Guelph Convertible Seat	Oil Burners

We will rebuild or overhaul your machinery. Experts only employed on the work.
Particulars upon request.

The Lang Manufacturing Co., Ltd.
Guelph, Ontario

The Art of Making Files

Some of our operatives have been making files since they were boys—and they are now old men.

The accumulation of expert knowledge and experience that goes into the making of our files is worth much to you.

It means that when you buy one of the following brands you have a finished product of the art of file-making:

Kearney & Foot
Great Western
American
Arcade
Globe

FILES

Made in Canada by

Nicholson File Company

Port Hope - Ontario

MAPLELEAF

Motor Trucks *Proved by Abuse*

A certain driver of a Mapleleaf two-ton truck belonging to the Shawinigan Engineering Company reported with not a little pride that he had carried 70 bags of cement weighing some 6,100 lbs. up a steep, rough road.

Not an example to be emulated, to be sure; but it does prove one thing, i.e.:

That the Mapleleaf Truck is capable of doing more than we claim for it, more than any truck is expected to do, and that in designing it the engineers allowed a super-margin of safety.

Mapleleaf Manufacturing Company
LIMITED
MONTREAL - CANADA



Built For *Service*

This BLOUNT Motor-driven Lathe is well adapted to all speed lathe uses. It is of late design, and has a number of features in which you will be interested. Provided with constant-speed motor. Lathe spindle made of hollow, high-carbon steel, ground to size and bored for Morse taper. Runs in self-oiling bronze bearings.

"We will accept Canadian funds at par"

J. G. Blount Co., Everett, Mass., U.S.A.

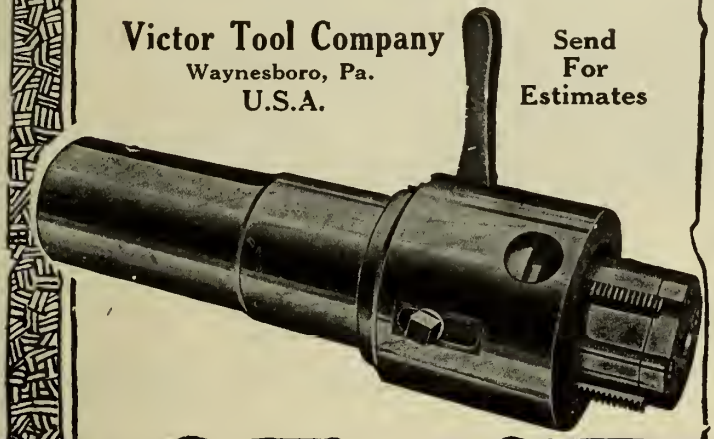
We wanted something original—this is what we got

"BOTH of these operations and half another — I'll show you later—completed in the time our old taps took to do one; that, I guess, is why we continue to use your Victor Collapsible Taps."

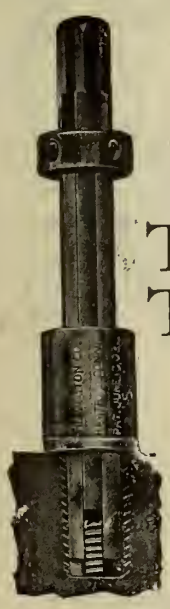
It was the often-heard story of time saved, of costs lowered, of all threads clean and smooth. And it was pleasant to hear.

Victor Tool Company
Waynesboro, Pa.
U.S.A.

Send For Estimates



Steel Fingers Slip into The Flutes



Grip the broken tap and back it out before you've had time to count three times sixty.

The Walton Tap Extractor

removes broken taps buried below the surface of the work without trouble or loss of time. It removes any broken tap without injuring the thread. It saves the casting or forging. Pays for itself over and over—often on the very first job.

How many do you want on trial?

The Walton Co.
Hartford - - - Conn.





MESTA MACHINE COMPANY
General Office and Works: Pittsburgh, Pa., U.S.A.

GAS AND STEAM ENGINES

for
Blast Furnaces, Rolling Mills
Power Plants
Gear Drives, Rope Drives, Condensers
Air Compressors Vacuum Pumps

ROLLING MILL MACHINERY

Blooming Mills
Slabbing Mills
Structural Mills
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Plate Mills
Universal Mills
Sheet Mills
Rail Mills
Tin Plate Mills
Doubling Shears
Squaring Shears
Plate Shears
Bloom Shears
Bar Shears
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Hot Saws
Accumulators

Roll Lathes
Chilled, Sand, Steel and Special Rolls
Rolling Mill Pinions and Gear Drives

SPECIAL MACHINERY

Steam Hydraulic Forging Presses
Steam Hydraulic Shears
Pickling Machines Metal Mixers
Iron and Steel Cut Gears
Iron and Steel Machine Molded Gears

FORGINGS

Large Engine Shafts—Piston Rods
Ship Shafts General Forgings

CASTINGS

Carbon Steel—Alloy Steel—Bronze
Air Furnace Iron Castings
Carbon and Alloy Steel Forging Ingots

Write for Bulletins

MESTA MACHINE CO.
Pittsburgh, Pa. U.S.A.

If interested tear out this page and place with letters to be answered.

DOMINION GRINDING WHEELS

Meet Modern Requirements

There's a Dominion Wheel for every grinding operation in your shop—a wheel made of suitable abrasives of exact grade and grain.

Dominion Wheels are made by expert workmen in a thoroughly modern plant. At every step in the process of manufacture, they are carefully tested. Thus we KNOW that every wheel which leaves the plant conforms rigidly to the Dominion standard of quality.

Have you tried them yet?

Dominion Abrasive Wheel Co., Ltd.
Mimico, Ontario



Made in Canada

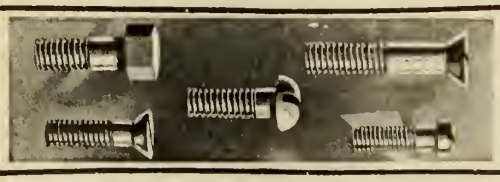
Dominion Grinding Wheels are Canadian-made from the raw product to the finished wheel.

By making wheels of abrasives from our own factory we are able to guarantee that they are uniform as to grade and grain.

Quality is the big factor in grinding wheels. Shops all through Canada are daily finding that the uniform quality of Dominion Wheels is equal to the world's best. Test a dozen against the wheels you are now using.

Wood Screw Making Machinery

SEND FOR CATALOGUE
Series



For sixty years we have constantly manufactured machinery for making screws, always studying to improve and refine our product.

Write or Wire us.

Cable address: "Cook,"
Hartford, U.S.A.
Codes: Liebers
Western Union

Asa S. Cook Co.
Hartford, Conn.

Dunbar

Springs *for* Every Use

We have been making springs of all kinds for 70 years. Let us advise you when in difficulty.



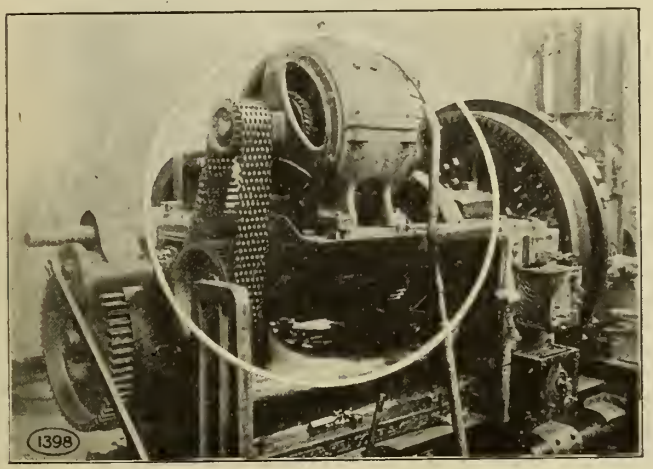
Tell us the purpose for which the spring is intended, and experts will gladly co-operate to see that you get the design best suited to the purpose.

Dunbar Springs are thoroughly tested for accuracy and quality. Send us specifications, for estimates.

THE DUNBAR BROS. CO.
BRISTOL, CONN.

RENOLD DRIVING CHAINS

(The Chains with a World-Wide Reputation)



20 H.P. "RENOLD" SILENT CHAIN OPERATING 36-IN. LATHE

are
POSITIVELY
the most
COMPACT
EFFICIENT
and
DURABLE

Means of Transmitting Power to Machine Tools

Write for our Booklet, 200/5
"Notes on Selection of Chain Gear"

HANS RENOLD OF CANADA, LIMITED 11 St. Sacrament Street, MONTREAL

LA SALLE

Has an Advantage Over Other Grinders

There is some outstanding feature of all La Salle Grinding Machines that lends it exceptional productive ability.
The American Drill Grinder is especially adaptable for grinding twist, flat and three-lipped drills, because it has automatic lip rest and caliper jaw device, which assures proper clearance on all sizes of drills automatically. Send for descriptive matter covering our entire line of grinding machinery.



American Drill Grinder
For Wet or Dry Drill Grinding 1/8" to 2¼". Also 1/8" to 3½" dia.

LA SALLE TOOL CO.
La Salle, Illinois, U.S.A.

Represented in Canada by
A. R. Williams Machinery Co., Ltd.
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Halifax St. John, N.B. Montreal Winnipeg Vancouver

Tycos

TEMPERATURE INSTRUMENTS
INDICATING-RECORDING-CONTROLLING

Whatever the specific demand for a temperature instrument, indicating, recording, controlling—somewhere in the broad range of the Tycos line is one that meets it exactly.

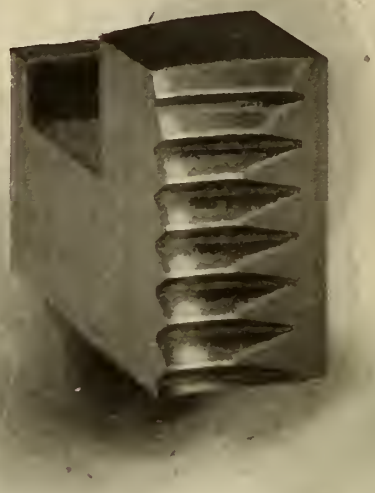
Angle and Straight Stem Thermometers
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Temperature and Pressure Regulators
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Request catalogs and details of application to your problems.

Taylor Instrument Companies
ROCHESTER, N.Y.
Canadian Branch:
110-112 Church St., Toronto, Ont.

There's a Tycos or Taylor Temperature Instrument for Every Purpose

The Acknowledged Leader



In every field of industry there is one acknowledged leader by which all others of its type are judged.

The Chasers of the HARTNESS AUTOMATIC DIE hold this enviable position. Their superior efficiency is not a mere claim, but the verdict of expert mechanics based upon exhaustive tests covering many years of service.

For precision work, we can furnish chasers with a lead guaranteed within 0.001 inch per inch of thread.

Quantity and quality of output are the predominant factors upon which their reputation is built.

Jones & Lamson Machine Company

(DIE DIVISION)

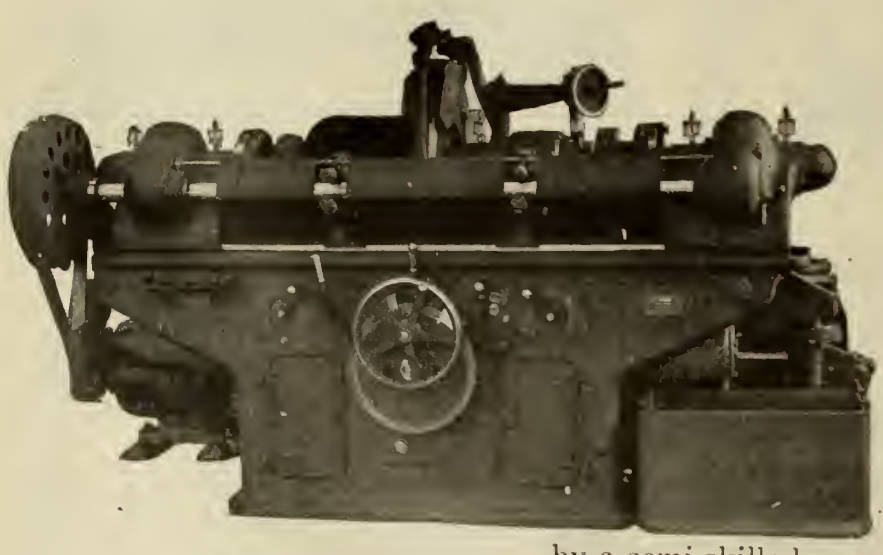
503 Market St., SAN FRANCISCO, CAL.; SPRINGFIELD, VERMONT; 9-10 Water Lane, Queen Victoria St., LONDON, ENGLAND

American Agents for Dies and Chasers

Biggs-Watterson Co., 1235-1237 West 9th St., Cleveland, Ohio.
Coghlin-Kirkley Machinery & Supply Co., Toledo, Ohio.
E. L. Essley Machy. Co., Chicago, Milwaukee and Moline.
Robinson, Cary & Sands Co., St. Paul and Duluth.

Foreign Agents:

France, Spain, Belgium—F. Auberty & Company, 91 Rue de Maubeuge, Paris, France.
Holland—Spliethoff, Beewukes & Company, Rotterdam, Holland.
Australia—McPherson's Pty., Ltd., Melbourne, Australia.
Japan, Manchuria, Korea, Formosa—Mitsui Bussan Kaisha, Ltd., Tokyo, Japan.
Sweden—A. Bol. Oscar Lindbom, Postbox 420, Stockholm.



LANDIS

Accuracy is Beyond Question

ABSOLUTE accuracy is essential, but it must be accompanied by simplicity and ease of operation. A good machine is one that is easily handled by a semi-skilled operator and is capable of turning out strictly interchangeable work in large quantities. **The best machine is capable of production records.**

The accuracy of Landis grinding machines is beyond question—and the Landis holds a lot of production records. The Landis is the predominant machine in modern grinding processes.

THE catalogue tells the story. Shall we send you a copy?

Landis Tool Company, Waynesboro, Pa.

Canadian Agents: A. R. Williams Mach'y Co., Toronto, Winnipeg, Vancouver; Williams & Wilson, Montreal

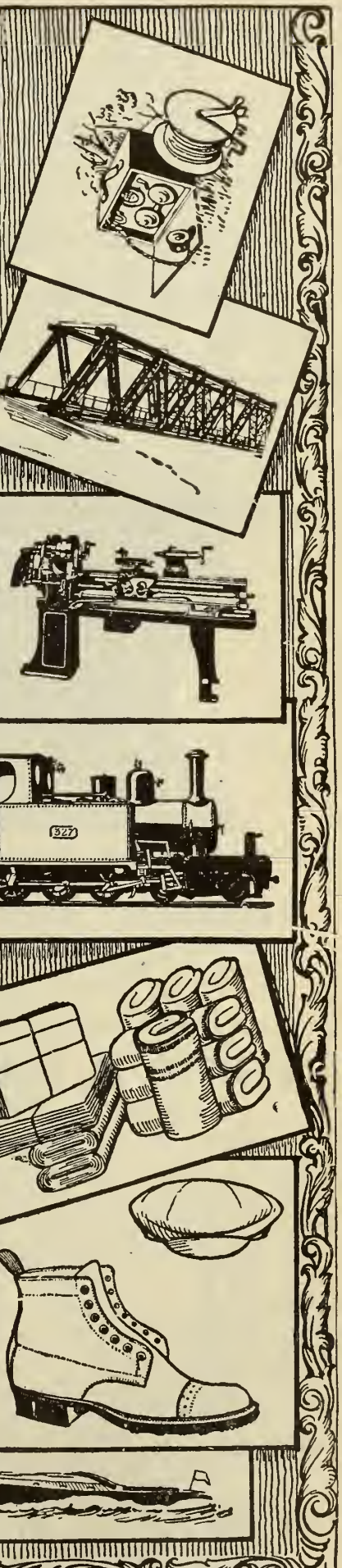
MINISTRY OF MUNITIONS
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The Disposal Board
Have
STOCKS
Lying in the United Kingdom and
AVAILABLE FOR EXPORT
of
ENGINEERING STORES

Ferrous and Non-Ferrous Metals
Plant and Machinery
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Factory Store
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Buyers should instruct their representatives in the United Kingdom to communicate with The Secretary, Disposal Board, Ministry of Munitions, Caxton House, Tothill Street, London, S.W. 1.

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"DISPEXPORT, MUNORGIZE, LONDON."



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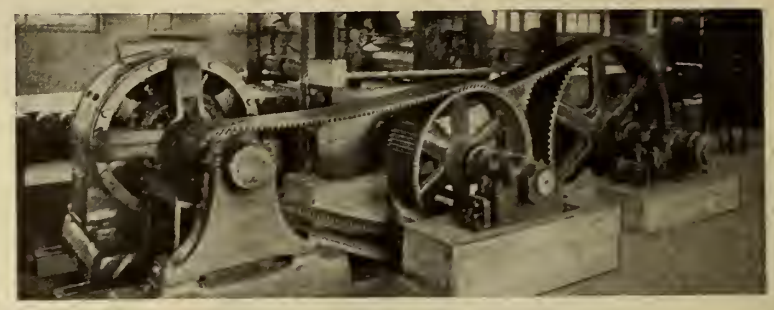
THE MORSE CHAIN CO.

are the
Largest Manufacturers in the world
of
High Speed Silent Chains

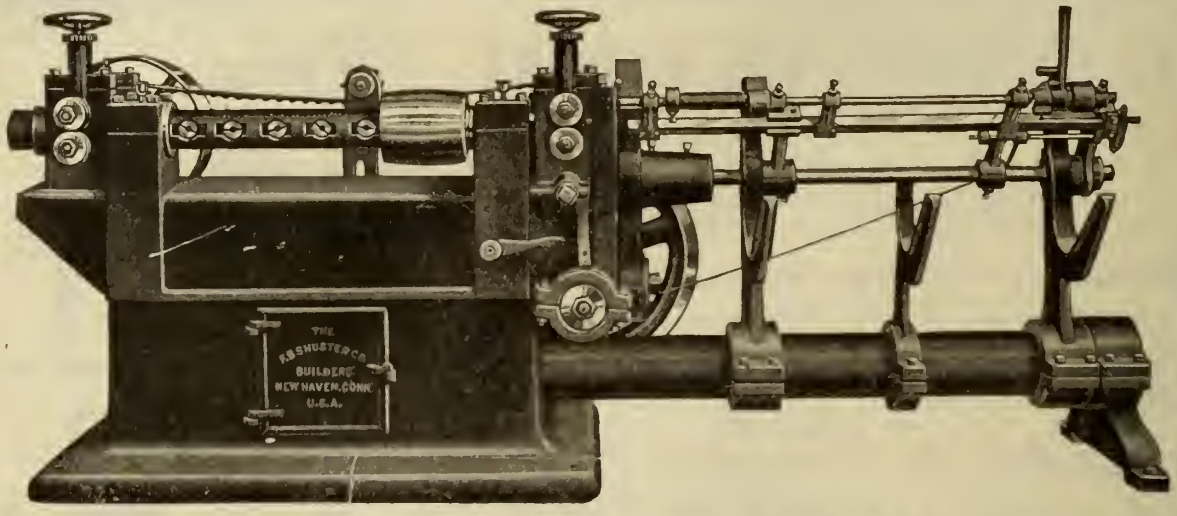
Why?

Morse Chain possesses the exclusive
Rocker Joint
Frictionless—Requires no Oilbath.

Jones & Glassco (Reg'd.)
Canadian Agents
Montreal - - Toronto



80 H.P. Morse Drive to Rolls, reverses direction every 45 seconds



Perfect Wire Straightening Quickly and Profitably Done on Our

Automatic Wire Straightening and Cutting Machine

Just put your coil of wire on the reel, adjust the rolls and dies, and set the gauge for the length you want. The machine does the rest—thousands of feet per day, perfectly straight and cut to accurate lengths.

Catalogue tells more about them, and we will be glad to send you a copy.

THE F. B. SHUSTER CO., New Haven, Conn.

FORMERLY JOHN ADT & SON ESTABLISHED 1886
ALSO MAKERS OF STRAIGHTENERS FOR SQUARES, HEXAGONS, FLATS, ETC.



STEEL PLATE CONSTRUCTION

Oil Storage, Gasoline Tanks, Air Receivers, Pneumatic Water Supply Tanks, Smoke Stacks, Boiler Breeching, Riveted Steel Pipe, Bins and Hoppers.

THE TORONTO IRON WORKS LIMITED

HEAD OFFICE: ROYAL BANK BLDG. TORONTO *WORKS: CHERRY STREET*

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CUT GEARS

Theoretically Correct

PROMPT SERVICE

ROBERT GARDNER & SON

LIMITED

52 NAZARETH ST., MONTREAL, P. Q.

RAWHIDE OR METAL







New Truths and Old Fallacies

Fusibility of Alloys—*Continued*

The best bearing metal may come to grief through mechanical defects, which no babbitt could withstand, or by reason of faulty lubrication, as a grease that is too heavy for a light running bearing, or an oil too thin for a heavy bearing, will invariably cause heating.

A highly fusible alloy rarely, if ever, gives timely warning before running out, whereas a Magnolia-lined bearing heats so slowly that it permits of either shutting down or cooling off the bearing, while running, without injury to shaft or bearing, and we shall recite cases where entire lack of lubrication has done no harm.

Tin is not the only metal that lowers the melting point of an alloy.

It is most natural to suppose that melting point of a lead-antimony mixture would not be lower than lead, but that the addition of antimony would even make it higher. The eutectic of this series is 87 per cent. lead and 13 per cent. antimony and the melting point is 447° Fahrenheit, or 212° Fahrenheit less than the mean of the two metals.

It is a common practice to guarantee the melting point of babbitt metals to be 600° Fahrenheit, and over, and to view this practice from a charitable standpoint, this guarantee is doubtless given because it is taken for granted that such ought to be the melting point. It is quite evident that the guarantors are not hampered by facts and have no definite knowledge upon which to base their assertions, but they run no risk of detection, as buyers are just as much in the dark.

We have a Die Casting Catalogue of recent date in which is given the melting point of their Genuine Babbitt as 810° Fahrenheit. We believe these figures were obtained from a college laboratory, which gives absolution from intentional misrepresentation, as it is highly improbable that such a wonderful alloy exists, but like many other babbitt manufacturers, they don't know any better.

Continued next month.

For copy of complete article:

"New Truths and Old Fallacies"

Address our Montreal Office

Sold by Leading Dealers Everywhere or by

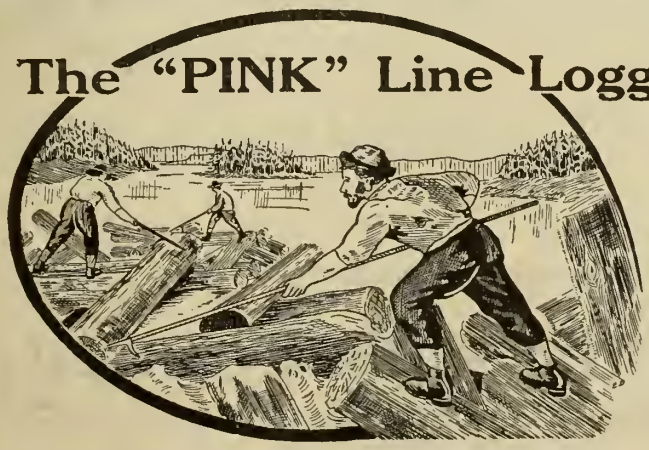
Magnolia Metal Co. of Canada

Limited

Office and Factory:

37-39 Shannon Street, Montreal, Que.

The "PINK" Line Logging Tools and Handles



MADE-IN-CANADA Products---Headquarters for British Empire for all Lumbering Tools

In every lumber camp in Canada you'll find PINK'S famous lumbering tools. They are the favorites there and have won the esteem of all woodsmen through their superior merit. They are world-renowned and are extensively used in Australia, New Zealand and other countries where the lumbering industry thrives.

EXPORTERS TO EUROPE

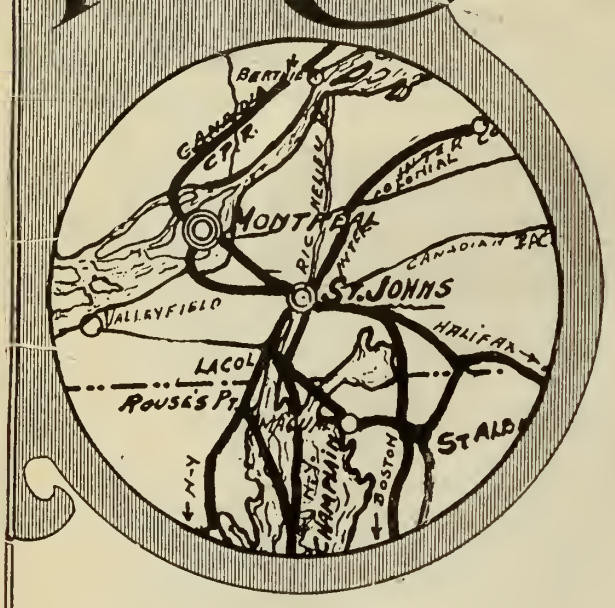
We export the same good quality of lumbering tools that have made PINK'S TOOLS a by-word in the matter of good tools in all Canadian lumber camps. Enquiries cordially solicited.

Thomas Pink Co., Limited

PEMBROKE, ONT., CANADA

If interested tear out this page and place with letters to be answered.

The City of ST. JOHNS, QUEBEC



Offers To Manufacturers—

A Cash Bonus On Your Payroll, Exemption From Taxes, Etc.

Already a busy industrial centre, St. Johns is rapidly expanding and now offers unparalleled inducements to encourage the establishment of new industries.

Every new industry is exempt from taxation for a period of fifteen years, such period being subject to extension. A bonus of 5 per cent. will be paid on your payroll for a period of five years. If you desire it, the city will advance this to you to be applied to the purchase or erection of any building suitable to your purpose. All public improvements you may require, such as street extensions, sidewalks, waterworks and sewage will be attended to by the city.

In addition to these inducements, St. Johns enjoys one of the finest industrial locations in Canada; has unequalled transportation facilities, an adequate fuel, power and labour supply, making it an unusual industrial opportunity.

No Other City Can Offer These Combined Advantages

Seven railroads, including Canada's great transcontinental lines.

Finest ocean shipping facilities.

Canal connections with New York, the Eastern States and the Great Lakes.

Cheapest labour market in Canada.

Plentiful supply of skilled and unskilled labour.

Cheap and abundant electric power.

Cheap coal and lower freight rates.

Desirable factory sites with all public conveniences immediately available.

Extraordinary inducements to new industries.

For more specific information write to

The Secretary of the City Council

ST. JOHNS, QUEBEC, CANADA

job at all times when purifier is being emptied.

vapor-proof globes are placed over light globes.

Goggles Save Eyes Every Day

SAFETY ENGINEERING has received from Mr. H. N. Leukart, of the D. A. Ebinger Sanitary Manufacturing Company, Columbus, Ohio, a pair of goggles worn by one of the company's employes, in the brass foundry, which, he thinks, will be of interest to students of safety.



Goggles That Saved a Molder's Eyes

Explaining the accident, Mr. Leukart says: "The person wearing the goggles was carrying a ladle of aluminum and part of it spilled onto a hard floor, causing an explosion. One can very readily see then if the molder had not had the goggles on, both of his eyes would have been very badly burned or burned out entirely. As it was, he was quite seriously burned about the face, especially on his nose. We are sending this exhibit, as it may help other manufacturers to impress upon their employes the necessity of using protection of this sort where there is any danger of injury to the eye, as there was in this case. The goggles were posted on our bulletin board so that all of our men could see them, and we believe the display has had a very salutary effect. At the time of the accident there were side guards on the goggles, one of which was broken off by the wearer in tearing the glasses from his face. The other one was taken off by us, so that they could be conveniently placed on our bulletin board."

From SAFETY ENGINEERING
Page 103, September Issue

The goggles were
STOCO SAFETY GOGGLES
(Pat. Dec. 12, 1916)
with CELOGLAS SHATTER-PROOF LENSES

For information and sample write—
on your own or your firm's letterhead—to

THE STANDARD OPTICAL CO.
GENEVA, N.Y. U.S.A.

If interested tear out this page and place with letters to be answered.

Announcing



the issuance of a new catalog of prime interest to all users of milling and gear cutters and small tools. Herein you will find listed styles and sizes of end mills (special and plain) T-slot cutters. Key cutters, thread mills, gear slots—in fact your needs in the small tool line of this class are sure to be covered. Get your copy and note its completeness.

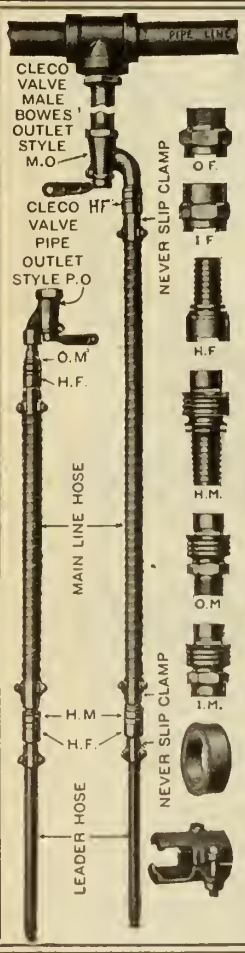
If your special requirement doesn't appear, Bilton can produce it—and in true Bilton Quality.

Just sign your name and address on a card and post it to

The Bilton Machine Tool Company
Housatonic Ave., Bridgeport, Conn.

Cleco Pressure-Seated Air Valves

Bowes Air Hose Couplings—Cleco Never Slip Hose Clamps and Cleco Grooved Hose Nipples and Hose Clamp Tool



STYLE O.F. is an Outside Thread Female Pipe End. Made in sizes ⅜-inch to 1½-inch.

STYLE I.F. is an Inside Thread Female Pipe End. Made in sizes ¼-inch to 1½-inch.

STYLE H.F. is a Female Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼-inch to 1½-inch.

STYLE H.M. is a Male Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼-inch to 1½-inch.

STYLE O.M. is an Inside Thread Male Pipe End. Made in sizes ¼-inch to 1½-inch.

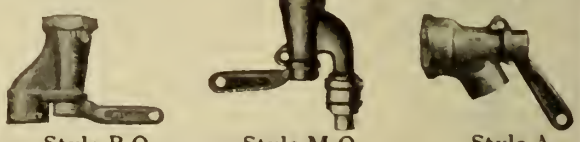
STYLE I.M. is an Inside Thread Male Pipe End. Made in sizes ⅜-inch to 1½-inch.

The Male and Female Ends of Bowes Couplings interchange in sizes ¼-inch to ¾-inch. Sizes 1-inch and 1¼-inch interchange. The 1½-inch ends interchange only with themselves.

BOWES COUPLINGS

Are instantly connected or disconnected.
They are absolutely air-tight under all pressures.
They quickly pay for themselves by stopping costly leaks.
They interchange in sizes most commonly used.
They have no loose parts to be mislaid or lost.
They are made of brass and will not rust.
The U-shaped Gasket interchanges in couplings ¼-inch to ¾-inch.

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Style P.O. Style M.O. Style A.

Style P.O.—Made in sizes ¼ in., ⅜ in., ½ in., ¾ in., 1 in., 1¼ in., 1½ in., 1¾ in., and 2 in. Pipe Outlets. Inlets are one pipe size larger.
Style A—30° Angle Valves, are made in sizes ½ in., and ¾ in.
Style M.O. Valve—Has 1 in. Inlet and Bowes Coupling Outlet. Connects with Bowes sizes ¼ in. to ¾ in.

CLECO GROOVED HOSE NIPPLES



Grooved Nipples when attached to the Hose with Wire Clamps as illustrated cannot "blow out." Wire clamp tool shown below applies the wires to hose.

The Lightening Hose Clamp Tool illustrated applies wire clamps at a cost of 1½ cents each.



Use Annealed Wire No. 14

In stock: Riveting and Chipping Hammers, Air Drills, Emery Grinders, Sand Rammers, etc.

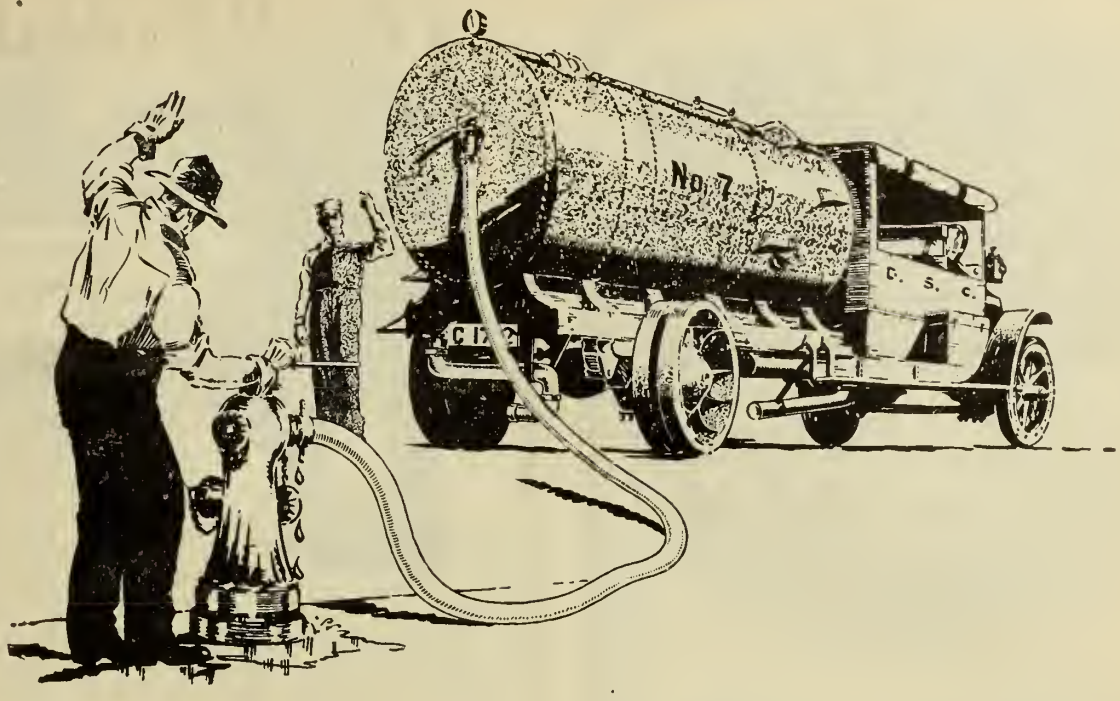
IMPORTANT:—The Small Leaks in your "AIR LINE" mean serious loss in DOLLARS. Have you any idea of the amount of "Air" wasted in small leaks at your connections? Air Leakage through 1-16 in. opening equals 5.32 cu. ft. per minute at 80 lbs. It will pay you to install Bowes Couplings and Cleco Valves, which will stop costly leaks.

Bulletins Nos. 43, 44, 46 and 47 mailed on request.

THE MODEL HOSE LINE illustrated shows correct styles of couplings and valve to use and proper way to attach the Cleco Never Slip Hose Clamps to Bowes Couplings. No "blow-offs" can occur when "Cleco" Clamps are used.

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New Standards of Economy Set by Goodyear Industrial Hose

The outside covering on Water Hose, unless tough and sturdy, quickly disintegrates under the constant dragging over sharp objects, particularly in outside construction work. The hose blisters and bursts.

Goodyear has overcome this with a rubber cover of exceptional toughness and strength, a cover which gives longer life—at a correspondingly low cost. The good inner tube and strong fabric are in keeping with this superior cover.

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If your business is hampered by the excessive cost and unreliability of old-fashioned hose, get the Goodyear data and the Goodyear hose plan. Let a trained Goodyear man advise with you. No obligation on your part. Phone, wire, or write the nearest branch or Goodyear Mechanical Goods Service Station.

The Goodyear Tire & Rubber Co. of Canada, Limited

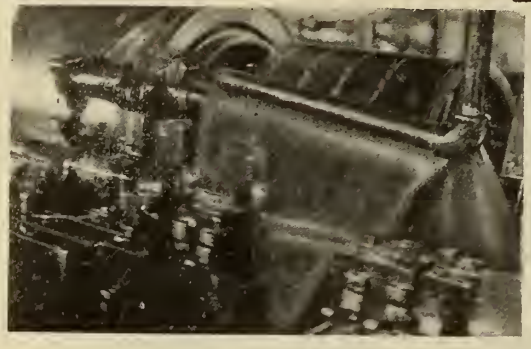
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LARCUL CUTTING OILS

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LARCUL AMBER

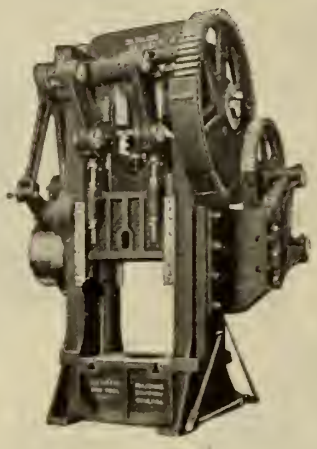
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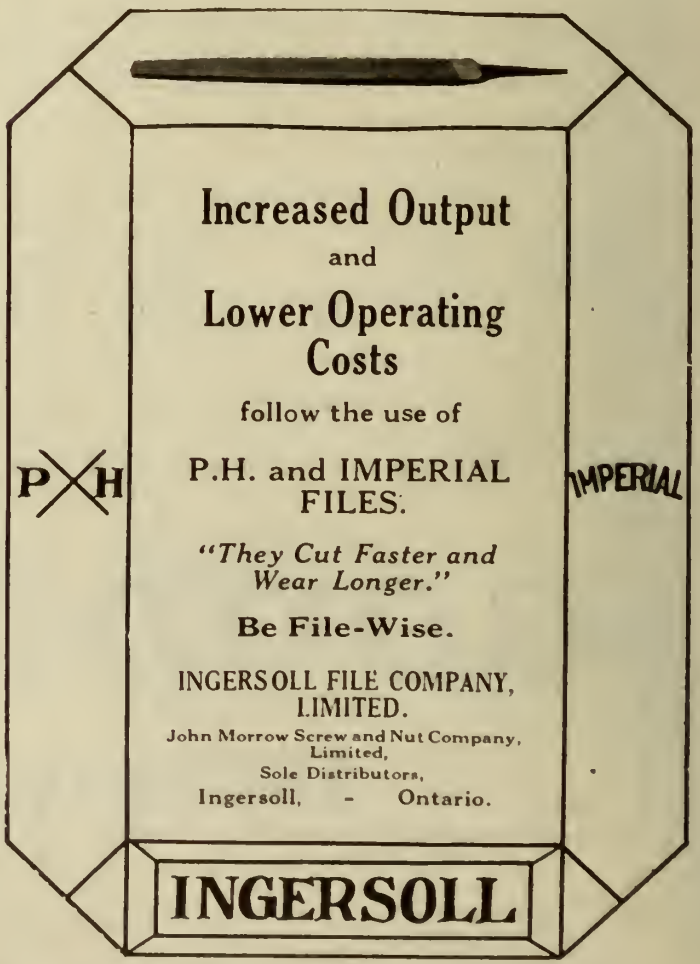


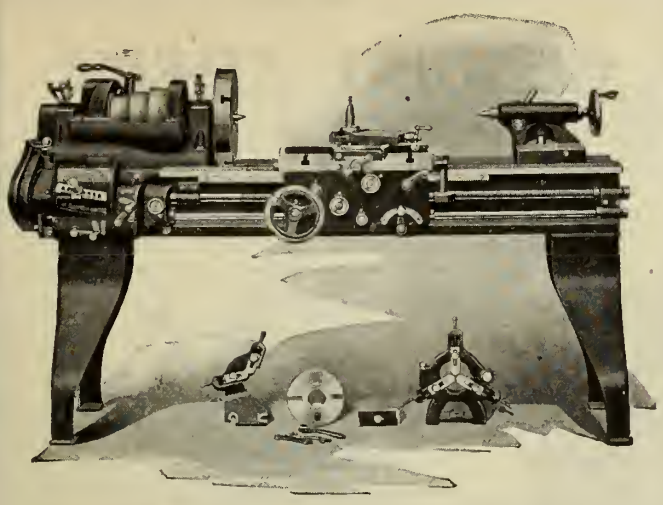
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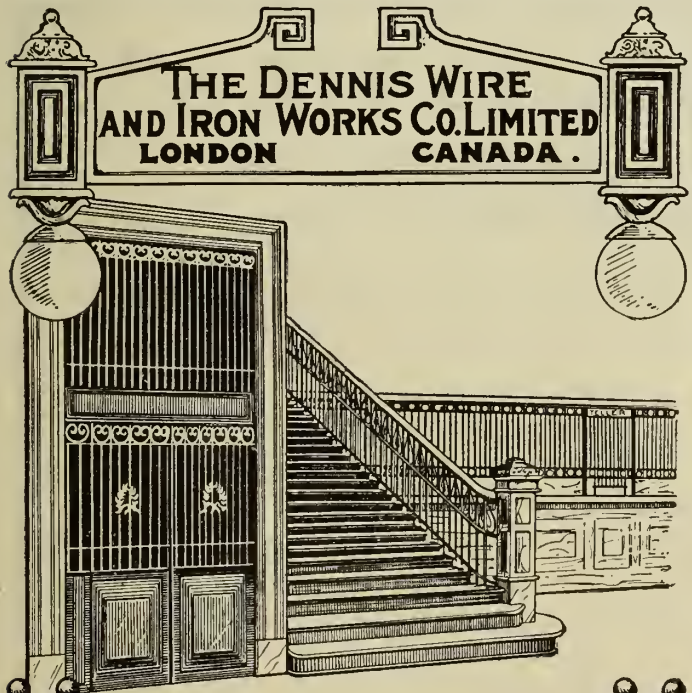
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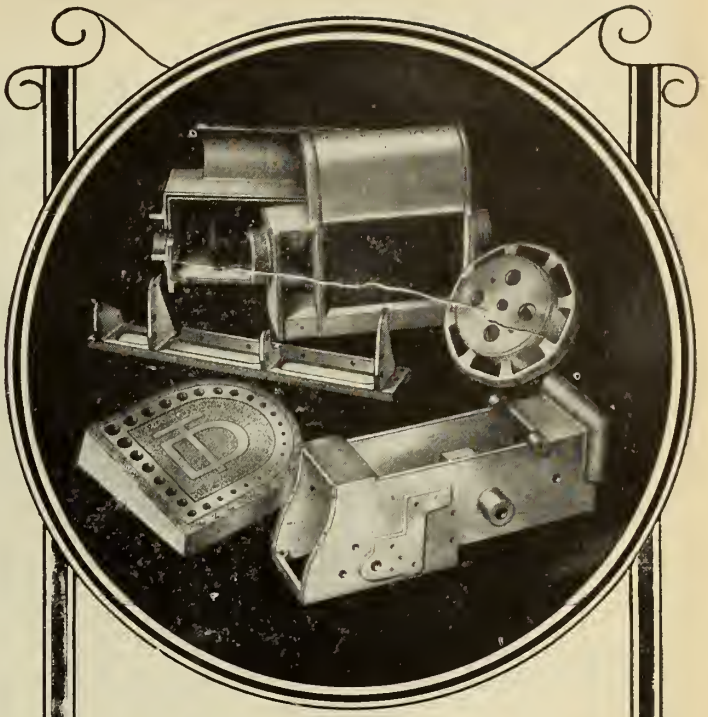
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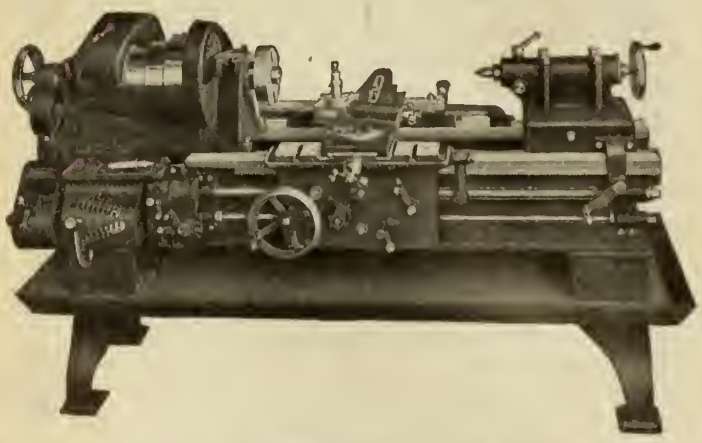
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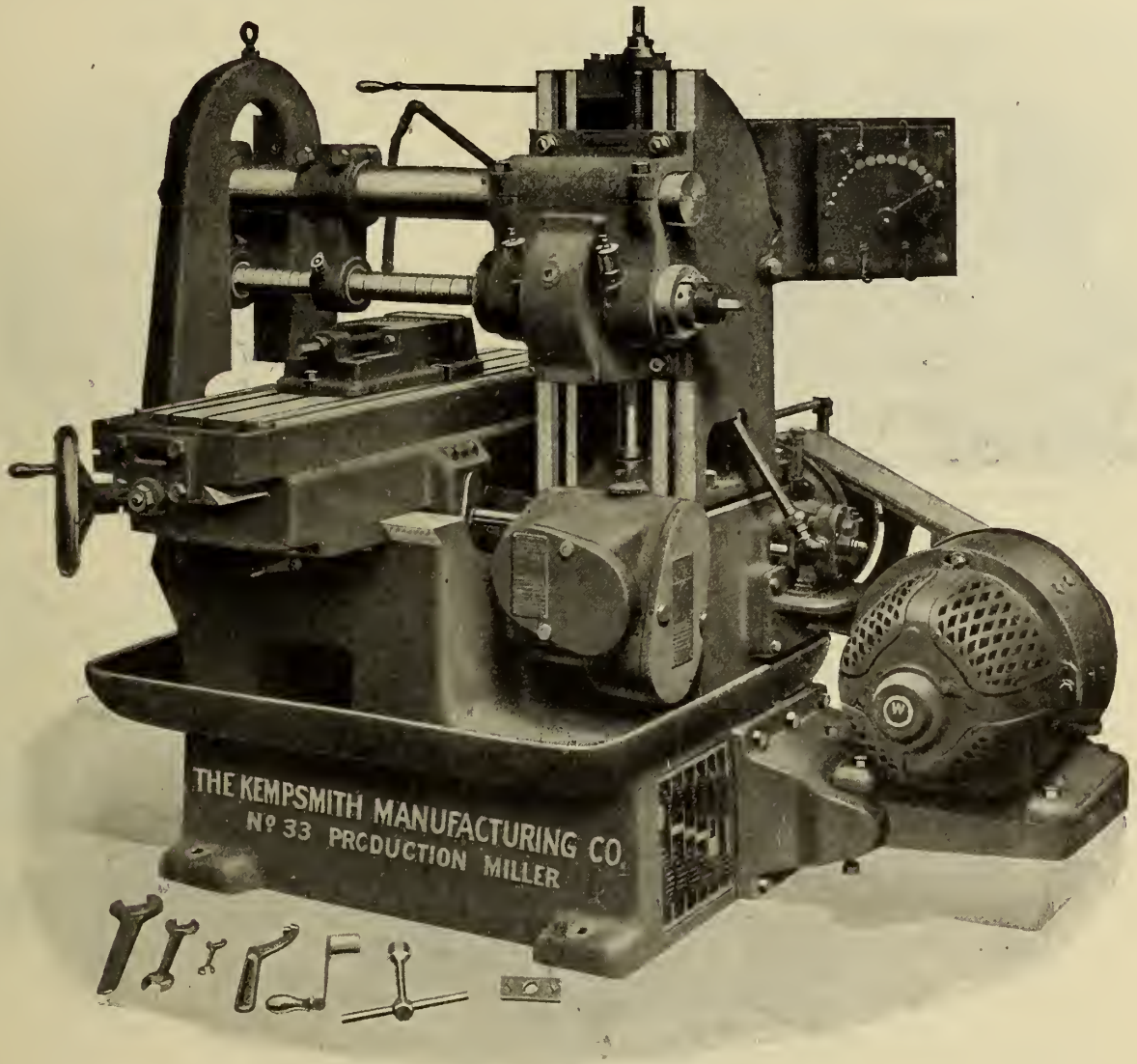
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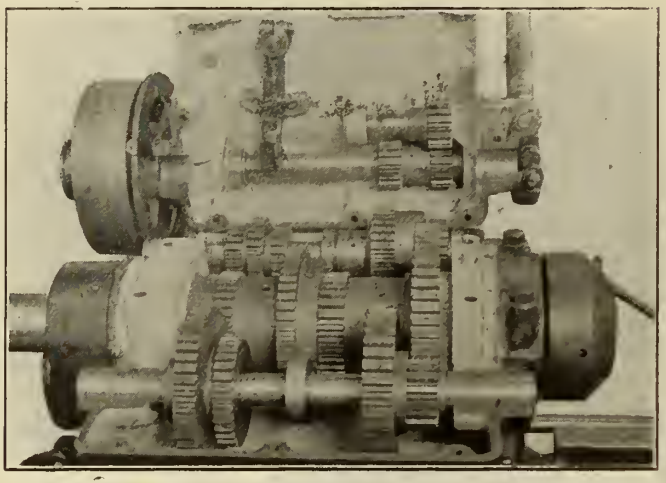
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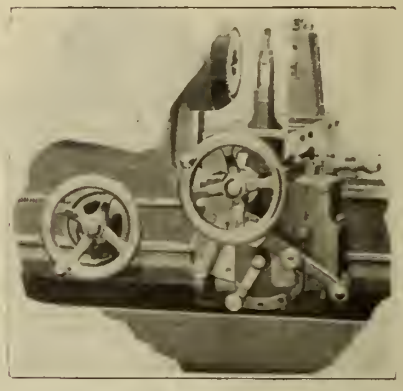
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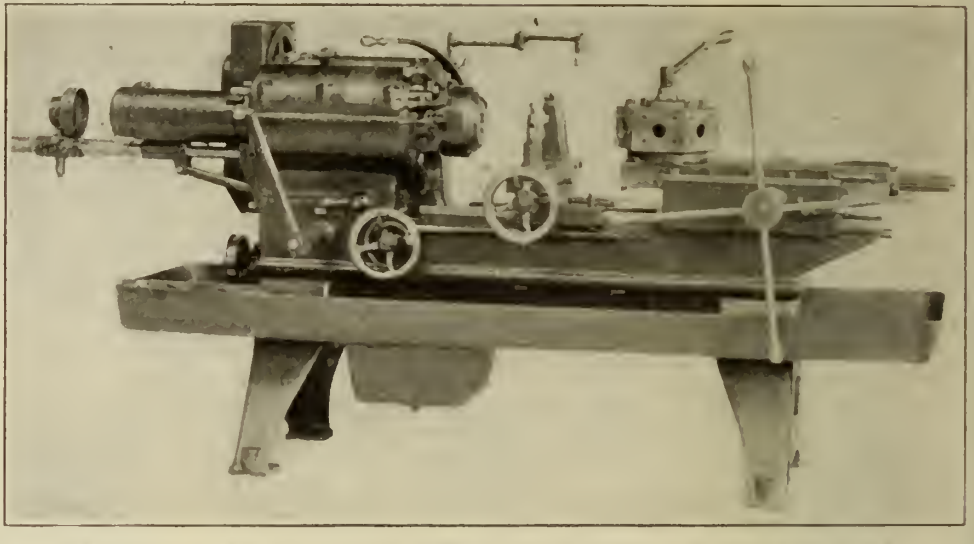
Turret Lathes



View showing arrangement of Gears in Head



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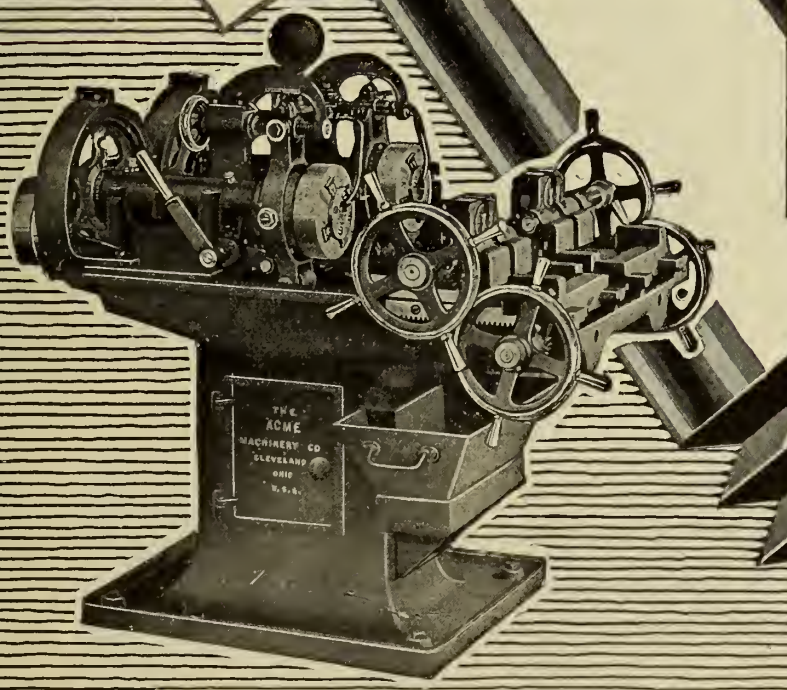
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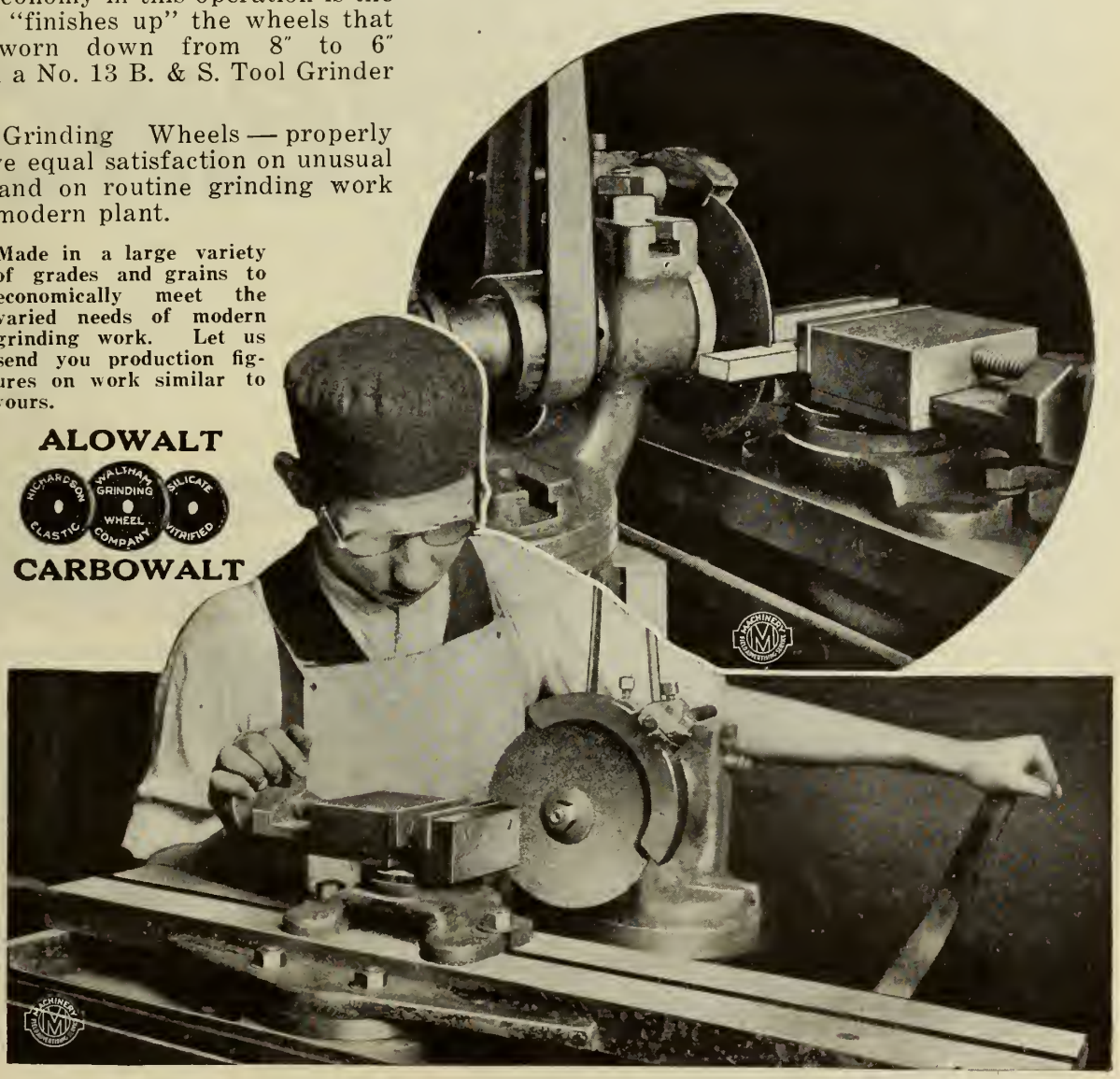
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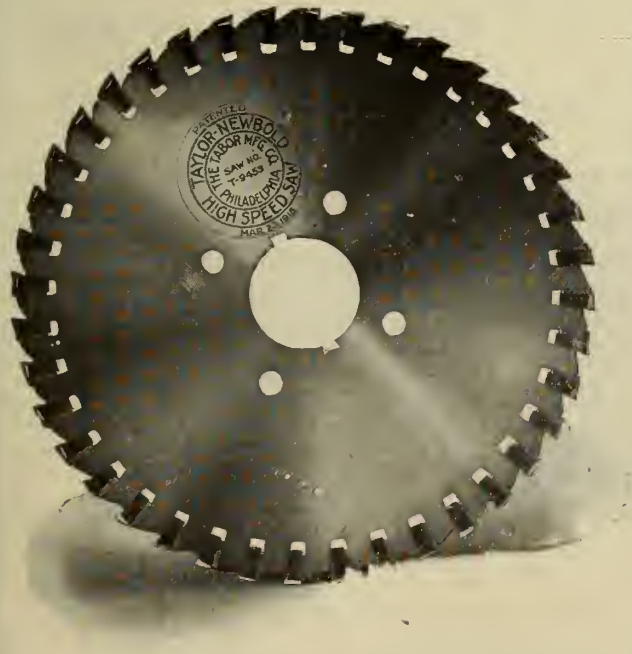
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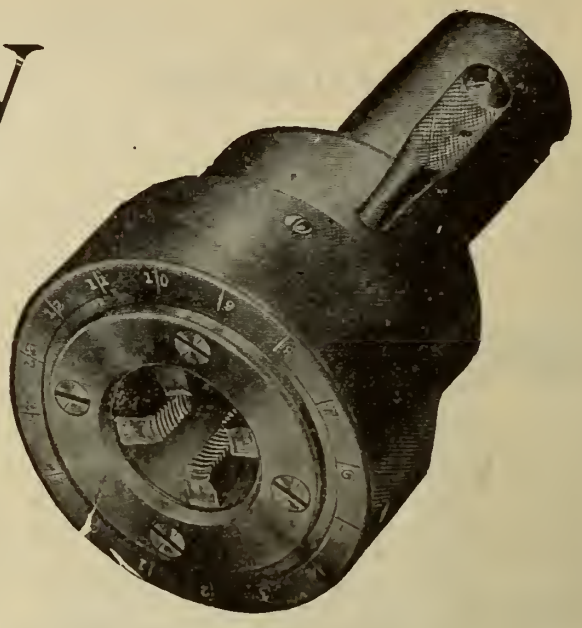
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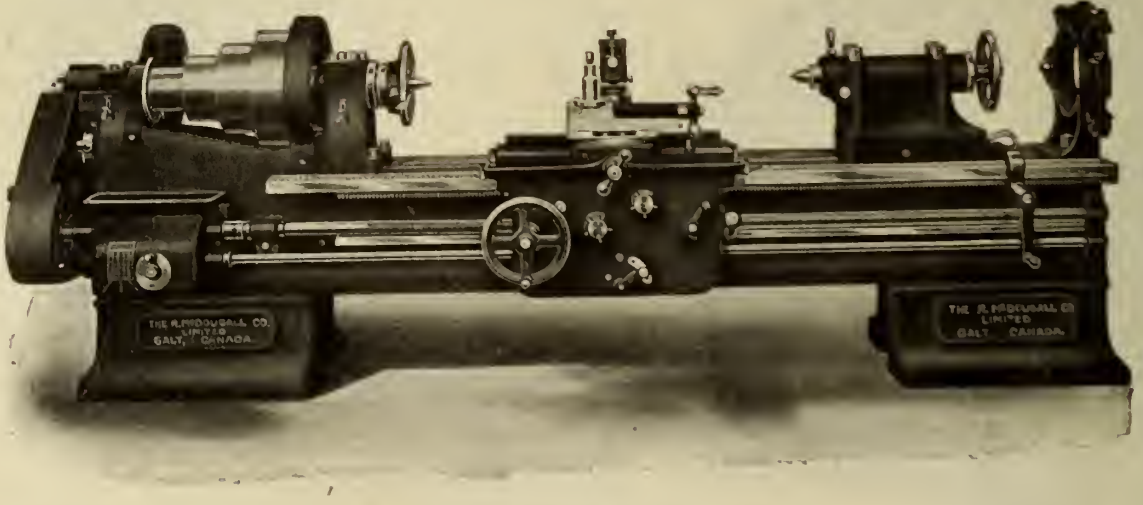
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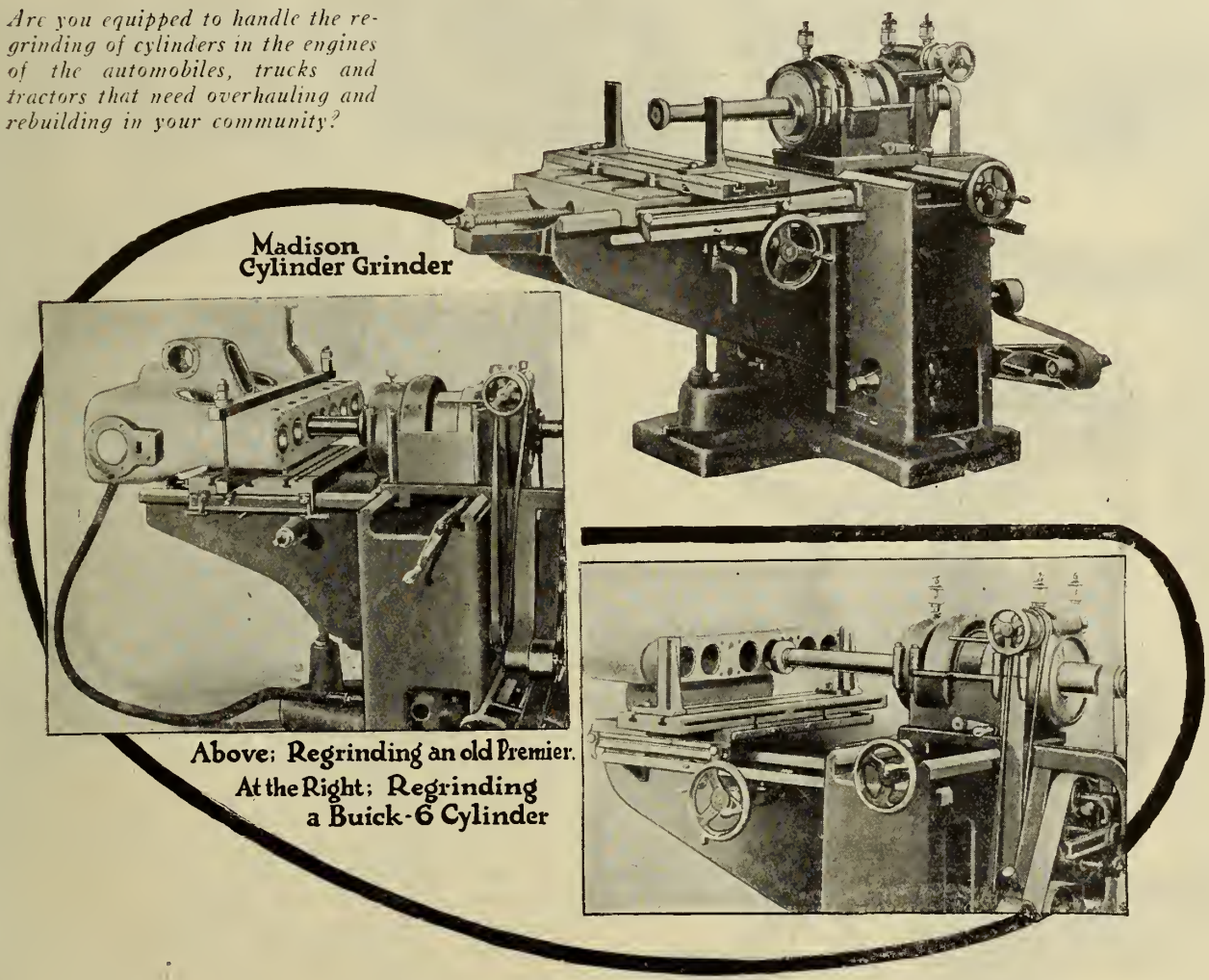


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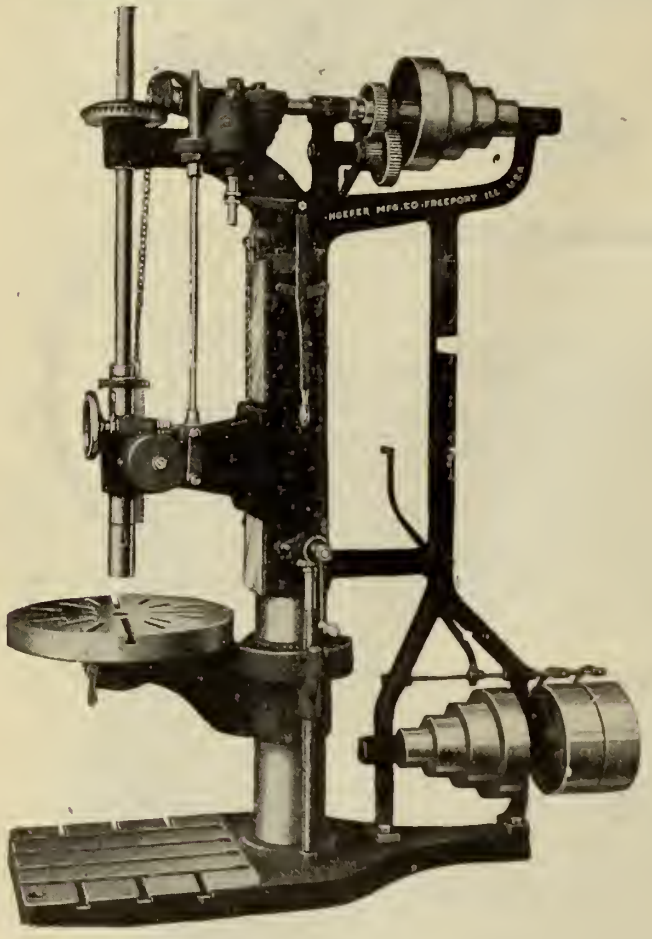
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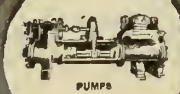
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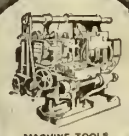
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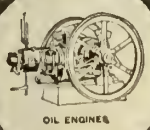

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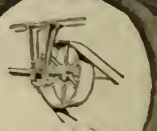

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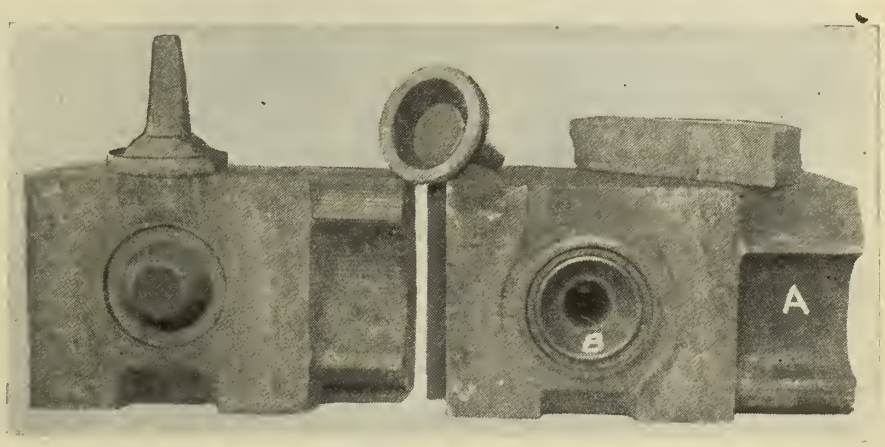
CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXIV. No. 23 December 2, 1920

Drop Forging

A Short History of Forging is Given, Together With Various Examples of Drop Forging Practice. These Examples Include Axles and Crank Shafts.

By J. H. MOORE



FORGING is at all times an interesting study, so before describing the new portion of the plant of the Canada Forge Co., let us delve for a short while into the art of forging itself.

The art of forging iron and steel by power hammers was introduced to America about the year 1850. This discovery proved so successful that research work was immediately commenced, with the result that forging has now become a scientifically developed art, and one of our important mechanical industries.

There are two commonly known types of forgings, namely, drop forgings and flat hammer forgings. The former type are so called because they are forged in dies under vertical power hammers, operated by efficient hammermen, while the latter class are made under either powerful steam driven hammers or hydraulic presses, operated by hammersmiths. Flat hammer forgings are usually of quaint and unusual design, and, of course, as can be understood, no dies are used. This is why the operators are called hammersmiths, and they must be smiths in every sense of the word to produce good work. This latter class of work is indeed an art, because forgings of unusual shape are being continually required in one piece from the very smallest up to forty tons in weight. It is easily seen that highly capable men only can be employed on such work.

The hammers used vary. Some are capable of striking each blow equal to from one-quarter of a ton to 60 tons. The hydraulic presses can in turn exert a pressure from one-quarter of a ton to 12,000 tons, if necessary. Take for example some ship and locomotive parts. These are so heavy that the hammersmith and his crew require power rotating devices and electrically driven cranes to handle the material to and from the furnaces, until the desired shape and dimensions are completed. The hammersmith is the man who must use his skill and judgment as to whether a light or heavy blow is required. While at the plant (later to be described), the writer saw them working on some huge billets 36 inches in diameter, and handled by rotary device, and it was a treat to watch the work proceeding. In this case a hydraulic press was used of 6,000 tons capacity.

Steels and Their Treatment

Wrought iron was at one time considered the best material for forgings on account of its ductility, and the great amount of vibration it could withstand before crystallization would set in. There are still uses for it, and in some cases it is claimed to be superior to



FIG. 1—THE BILLETS BEING HEATED.

FIG. 2—WORK COMING FROM THE ANNEALING OVENS.

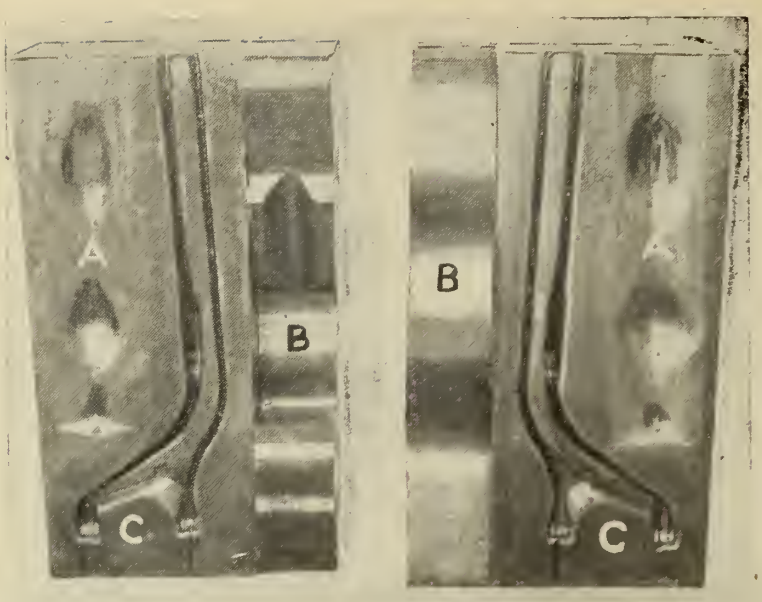


FIG. 4—DIES USED TO PRODUCE THE FRONT AXLE OF AUTOMOBILE.

other metals. Such cases are hull forgings for ships, stern frames, posts, rudders, etc. Modern engineering practice, however, with its demands for greatly increased loads and hard service, requires, for certain parts of heavy machinery, forgings which will have two or three times the strength and rigidity of iron, and will at the same time combine with these qualities the factor of ductility. These qualities are to be found in what is generally known as open hearth steel forgings.

The steel must, of course, be of proper chemical analysis for the purpose required. In the case of small forgings, rolled steel billets are used and worked to shape under steam hammers, while the larger work from steel cast ingots is generally done under hydraulic presses.

It is a well known fact that the working of the hot steel not only provides a means of shaping it to form, but at the same time refines the grain structure, and tends to increase its density and dynamic strength. The steel is first heated to what is known as the critical range of temperature, and in order to acquire the best results the finishing temperature in working should be just within this critical range, in order to increase the elastic limit and the period of endurance in service of the forging. This range of course depends upon the nature of the steel.

During the process of working, and the alternate cooling, internal stresses and strains are created, which can only be neutralized and made homogeneous through heat treatment in special furnaces regulated usually by electric pyrometers. The importance of heat treatment is to make the steel possess certain physical properties best suited to the purposes intended, and this is accomplished by increasing its ductility, elastic limit, and tensile strength.

To obtain proper heat treatment, you require, what is obvious, namely, good material, proper equipment, and a knowledge of correct procedure. Experience is a great thing in the art of heat treatment. This plant does its heat treating in car type overfired furnaces. This style of furnace removes all forging strains and stresses, thus insuring the greatest degree of safety by still further refining the grain and creating a higher degree of toughness in the finished forging. All the forgings at the plant we speak of are thoroughly tested and inspected before being permitted to leave the factory.

The foregoing information has been mostly on their flat hammer work, and before leaving the subject, let us look at Figs. 1 and 2. In the first view we see two billets being heated in the furnace, while in the second picture we notice some of the work which has just been annealed. The size of these forgings is self apparent, and a good method of comparison is to look at the size of the crane chain links, then study the size of the work. It might be well to add that this concern make practically all their own furnaces, and use burners of their own design.

Before the material is used for forging purposes, it undergoes a severe test in the chemical and testing departments. An analysis is taken of all material entering the plant, and every particular is known and indexed on file. Usually the chief constituents are marked on the end of the billet as it rests in the yard. For example, the writer saw one particular billet which was marked Chrome 1.37, Nickel 3.02, 22" x 22" x 7'-2". 11900 lbs. This information gives the smith all necessary data for his purpose.

Drop Forging

And now, having touched on the flat hammer work, let us consider some examples of drop forging practice. The first example depicted is the heading. This shows a separator stem made for



FIG. 5—THE VARIOUS STEPS NECESSARY TO COMPLETE A FRONT AXLE FOR AUTOMOBILE.

the Massey-Harris Co., and its method of manufacture is very interesting.

The work is first heated in the furnace, and this is done in a furnace of double construction of their own make. It is equipped with four burners of their own design, and by means of these burners the furnace can be run 10 hours on 24 gallons of crude oil. This is a splendid record, and speaks well for the burner construction. The billets are heated from 2200 to 2300 degrees Fahrenheit, and the hammer used to drop them to shape is of 6000 lbs. capacity. It might be well to explain that the billet is 3" square and 13" in length, thus allowing for the making of two stems.

We will suppose the billet has been heated and is ready for the hammer. The following steps are now followed out. The stock is first edged down near the middle of billet on the portion of die marked A. It is next placed over the center impression of bottom die B and the blows struck. Usually 6 to 7 blows complete the form. After this, it goes to the trimming press and is trimmed.

This operation is worthy of special mention as a hydraulic press of 150 ton capacity is used. This press was employed during the war for shell work. They simply switched it over to peace time duty, and as they had it all piped up and the water there, it costs practically nothing for maintenance. Of course such a press could not be used in the average case, but the fact of its being in use makes it worthy of mention.

The fash is next cut off at end of billet, and the hammer makes a tong hold on the remaining stock. It now goes back into furnace and after reheating, the operation is repeated. Twelve billets are carried at one heat of furnace, or in other words, 24 forgings. The production of this piece is 300 stems per 9 hour day, and in the making of the die some 1800 lbs. of steel are used.

The next photograph, Fig. 4, depicts the die used to forge the front axle of the McLaughlin Buick Car. The billet in this case is 2½" diameter, and 41¾" long in its rough state. To further explain the procedure in forging of the axle we have prepared Fig. 5, which illustrates the various steps in its progress.

The stock is first placed into what is termed the roller (see A) to gather balls, or a greater amount of stock in certain sections, and reduce the amount in others, so as to distribute it properly to place in the binder, or second portion of die (see B). The purpose of the second form is to bend the stock up in proper shape so as to fit the third impression C as closely as possible. It is now placed over final impression C, and hammered to shape. Usually six to seven blows are sufficient. This view shows the roughing set of dies only, and as will be noticed, takes care of only one-half of the axle. This is the method of making these axles one-half at a time.

After half of the axle is rough finished, it goes to the finishing die, this consisting of but one impression. Five or six blows bring the forging to correct form, and the axle must be correct as to bosses, pad and web of beam. From here it goes to the trimming die to remove fash, or surplus material. It is then returned to the hammer and restruck, as sometimes the trimming die will bend the forging. The other end of axle now goes through similar operations.

After leaving the hammer the axle next arrives at the bulldozer. It is practically impossible to forge a piece of such nature to accurate length, so that this is where the bulldozer comes in nicely. The forging is made a shade heavy on the beam, and in this last operation the bulldozer stretches it to exact length, and makes sure all pads are correct. In action, here is what happens.

The axle is placed in a form of correct shape, up comes the moving head, and a spreader strikes the center portion of axle, thus spreading it to accurate length. The axle is gripped tight on each end by clamps shaped to suit the web. The spreader has two rollers on it which engage with tool steel tapered guides. These spread, and in turn spread the axle. While this occurs two rams attached to the die heads flatten the spring pads. This operation eliminates any machine work on these pads. The machine can turn out 450 axles every 9 hours, and the production on the hammers is as follows: 400 ends blocked and 400 ends finished every 9 hours.

The forgings used in the axle making are blocked in one hammer, taken over to the furnace of second hammer, then heated there. This saves a great amount of heat, and the two hammers, namely blocking and finishing, work in tandem. It is estimated that 75% of

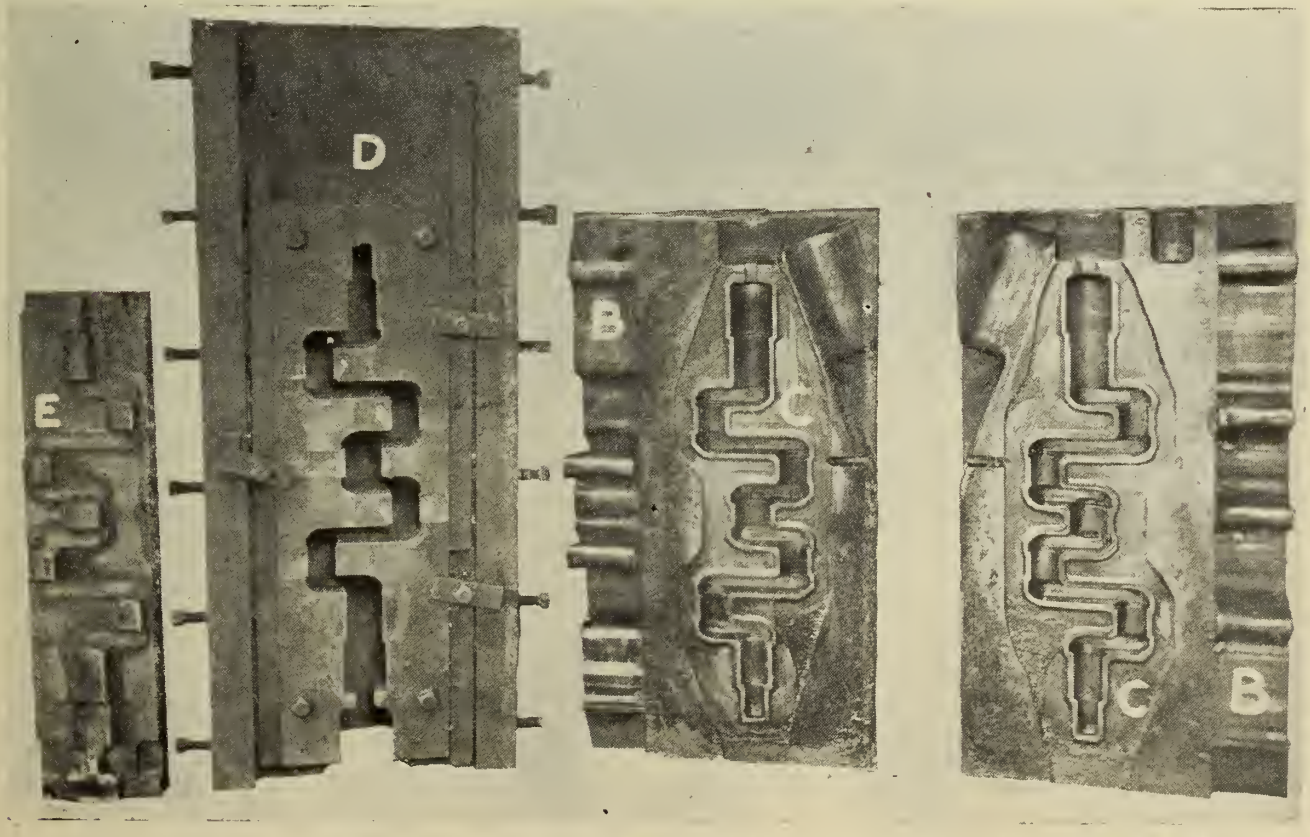


FIG. 6—THIS SHOWS BOTH DROP FORGING AND TRIMMING DIES USED ON AN AUTOMOBILE CRANK SHAFT.

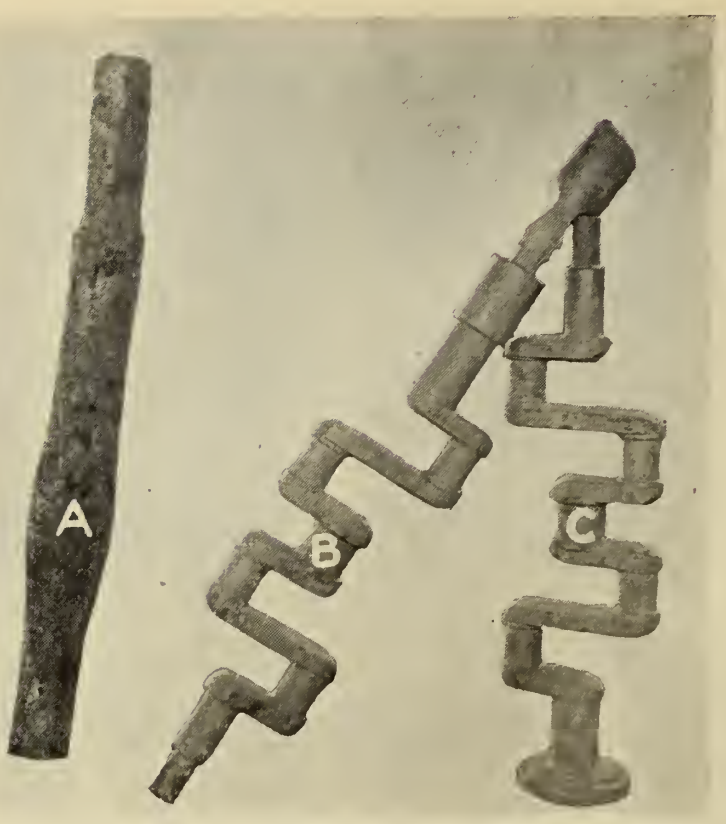


FIG. 7—STEPS IN THE MAKING OF AN AUTOMOBILE CRANKSHAFT.

heat is saved in this way. For example, when the first operation is completed, the forging is still a cherry red. This being so, it does not take long to heat it up to the proper forging heat for finishing operation.

The bending impression B, (see Fig. 4) is not made with any idea of forming to finished shape, but the idea is rather to have sufficient stock at the correct place to form up nicely on the impression C. The dies which we have just been discussing required two tons of steel to make them, and cost in the neighborhood of $1,500. Referring to Fig. 5, we note that A represents the rough stock, B one-half of axle rough forged, C one-half finished forged and trimmed, D the other half rough forged, and E the completed axle. These steps, together with previous description, will no doubt be perfectly clear.

Crank Shaft Die

The next example, Fig. 6, depicts the dies used to produce the crank shaft for the Chevrolet Baby Grand. In this case they use stock 3½" diameter, and draw it down to 2½" diameter on both ends. This is accomplished on breakdown, or swedger, shows at extreme side of each die block, see Fig. 6. This portion of die prepares the stock for the finishing impression. The stock as it appears after the swedging operation is shown at A, in Fig. 7.

Let us again refer to Fig. 6. The stock is next placed in the bender at B, when it is formed up to shape and rough outline of impression. It is next placed over the finish impression C, and struck sufficient blows to bring to required size. From this operation it goes to the trimming press and fash removed. These trimming dies are shown at D and E and they are so designed that forgings will drop through freely. After trimming, the piece is returned to hammer and restruck to make sure there is no twist in the crank.

From here it goes to an upsetting machine, which has a pressure of 200 tons. The stock is inserted in the lower die of the machine, and a vertical ram with upper die attached grips the crank firmly. The horizontal ram now comes forward, and a heading tool enters the die and upsets the flange shown at C in Fig. 7. B in this same view illustrates how the crank appears before upsetting. This flange is completed with one stroke of the ram. In the forging operation 180 cranks are completed in 9 hours, and 350 are upset in a similar period.

Designing Dies

Before proceeding with further examples of dies, it might be well to explain that this concern prepares all their own dies, even to supplying the steel for the same. They are, in other words, a self-contained organization. They have a die sinking department, a tool room, a machine shop, etc. These various units are all in Welland and under the heading of the Canada Foundries and Forgings, Ltd.

Suppose, for example, that a new piece comes into the plant, which has to be drop forged. The following vital points must be observed. First, the blue print, or sample, must be studied and measured in order to decide the size and width of block to be used. As a general rule, on a heavy hammer such as the 6000 lb. we have been speaking of, a die block is never made less than 12" deep. This, of course, is in order that the block will be able to resist the strain exerted on it. The width must also be sufficient to withstand strain, apart from the planning of proper width to accommodate the main impression, and other operations such as bending, edging, rolling, etc., etc. The rolling, by the way, is really the gathering of the stock in a certain place, as for example in Fig. 4, at A. Another general rule is to leave at least 3" of each side of impressions.

Having decided upon these points, a



FIG. 8—SINKING A CRANK SHAFT DIE.

templet is made from the drawing and the dies are all laid out from these templets. The laying out and die sinking is done as a rule by one man, and the average time, on, say such a die as the crank shaft die shown, is approximately 40 to 50 hours. Take for example, Fig. 8. Here we see the operator cutting out, or to use the proper expression, sinking a crank shaft die. A roughing tool is first employed, after which a 7 degree cutter finishes the work. Where awkward shapes occur, such as semi-circular grooves, a cherrying attachment is often employed. After die sinking is completed, the die goes to the bench and there is filed and smoothed with fine emery paper.

The die shown in course of preparation is for the McIntyre Motor Co., Kalamazoo, Mich., and the shaft measures 34⅞" over all. We give these dimensions in order that readers can form some idea of the general proportions of the die. The average bearing is 1.9985" diameter, the collar at the end of crank is 5". diameter, and the section is 1⅜" thick plus 2½" wide with a 7 degree flare.

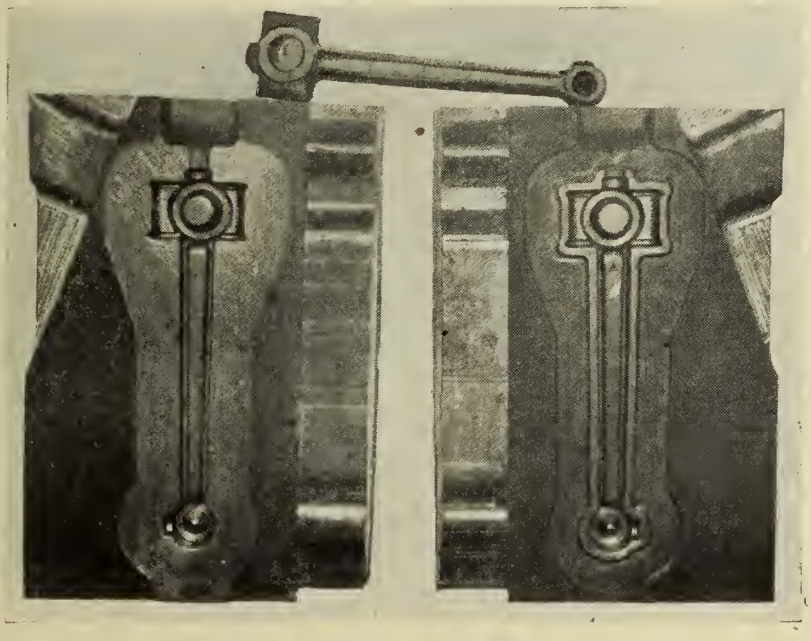


FIG. 9—CONNECTING ROD DIE FOR GAS ENGINE CONNECTING ROD.

Another Example

The next example, Fig. 9, illustrates the dies used to forge a 1½ h. p. gas engine connecting rod for the Kerr & Goodwin Co., Brantford. The steel for this job is approximately 1¾" square in the rough and it goes through the following steps in sequence. The center of stock is drawn down at corner of die, then is placed in edger. This rolls the stock to proper shape and size. It is now placed in finish impression and blows struck. It is next trimmed, from there going back to the press to be straightened. It now goes to the punch, and has the eye punched out, thus completing the rod, as far as they are concerned. The rod is 11⅝" center to center, and the web is of I section, approximately 15/16" wide, with 3/16" thick center web. These few dimensions will be sufficient to allow readers to form their own ideas as to complete proportions of the die.

Other Features

In conclusion, let us refer briefly to some of the equipment used in this new drop forge plant No. 4, as it is called. The building itself is 80 ft. x 220 ft., of steel construction, with concrete floors throughout. Two 6000 lb. steam drop hammers, two 200 tons hydraulic presses, one 5" upsetter, one 60" bulldozer, two electric trucks, one 15-ton electric crane, and of course the attendant die sinking department.

The steel used on their die blocks is made from Ni-Krom die block steel, and, as stated before, is of their own make. An automatic furnace is also at present being installed, and this in itself will be an important addition to the rest of the equipment. The action of such a furnace is so self-evident that we make no special comment on the same except to say it is of their own construction.

The machine shop connected with this portion of the plant accomplishes the rough and finish machine work if desired, and is well equipped for both large and small work. In addition to the chemical and test departments, a fine first aid room is installed, and in this room is even the equipment necessary for operations should they be required. The workers in charge of the department are ex-army medical men, who thoroughly understand their business. While this new portion of plant was primarily intended for making forgings for automobile work, it is well equipped to handle any work of a forging nature, and we are led to understand that still further additions will be made as soon as working conditions permit.

COMPRESSED AIR OPERATES STENTORIAN PHONGRAPH

New uses for compressed air are being almost constantly found in the basic industries and in specialty manufactures, comprising largely of course the utilization of well known principles in compressed air practice. Occasionally an entirely new idea comes to the fore, one of such that has lately come to light being from the fertile brain of Gaydon, a British engineer. Mr. Gaydon has demonstrated his invention of a phonograph with a voice that would even wake up our commerce board.

It is reported that the inventor tested the voice of the machine on his neighbors in a London suburb, and that the tune played could be recognized by auditors more than two miles distant. The instrument is called the "stentorphone," after Stentor, the Greek herald, who was reputed to have a voice like reverberating thunder.

Compressed air and a new species of sound box are declared to be the secrets of the invention. The air is supplied by means of an electric motor, and when it passes through a small valve controlled by the phonograph needle, it expands and creates a burst of sound that in the case of vocal selections, at least, surpasses by many times the volume of the original voice. It is said that to a person standing about 30 yards from the instrument the illusion of a brass band playing at about an equal distance is almost complete. The most entertaining results, however, are derived, when a vocal phonograph record is placed on the stentorphone. At the time of the public test, when Sir Harry Lauder's "We Parted on the Shore" was played, it sounded like the voice of the mightiest giant that ever stalked through the pages of a fairy tale, according to the reports.

Mr. Gaydon thinks that the machine can be used as a drill sergeant, giving the words of command before playing the marching accompaniment. In battle it might be used to drown out the shrapnel crescendo and scare the enemy to death, is another militant suggestion. It has also occurred to the inventor that possibly it can be used to deliver the speeches of political candidates in a way that will baffle the obstructive tactics of the loudest-voiced and most persistent heckler.

The Federation of British Industries has devised a unique scheme for advertising home manufactures in all parts of the world. A new steamship, to be called the Federation, is to be constructed by some of the leading firms of the country as an exhibit of British marine engineering. The cargo of the ship will consist of various articles of British manufacture. Representatives of the firms interested will make the voyage for the purpose of showing their goods and interviewing foreign buyers.

Some Interesting Machine Shop Problems

Various Problems on Machining Bearings Are Solved, Also the Fitting of Brass Lines for Marine Propeller Shafts—A Simple Centre Jig is Described, and Other Ideas.

By JOHN S. WATTS

THE notes that follow are on a variety of topics, connected only by the fact that while all the points made were common knowledge and practice with the old time all-around machinist, my experience with the younger mechanics leads me to believe that they are unfamiliar with much of the useful knowledge acquired by their predecessors, when a man usually followed a job through to actual operation, and so gained experience which is not generally available to the mechanic of to-day.

The lack of technical schools and journals in the years past had a tendency to make the mechanic of those days a man who studied things out for himself, and acquired a habit of analytical study which enabled him to arrive at the correct solution of any problem which he encountered. On the other hand, I find that knowledge gained from the experience of others does not become a part of oneself, and is not so thoroughly grasped as that which has been acquired by the use of one's own intellect.

While it would be absurd to condemn the training of apprentices, it unfortunately does tend to weaken their self-reliance, and the mechanic of to-day, will, 99 times out of a 100, refuse to tackle a job which he has not been taught to do. This is a fault which he should fight against, and is in the last analysis simply a form of mental laziness, as the well trained and educated mechanic of these days should, with his wider knowledge of the laws of mechanics, be more able to handle the unusual job than his predecessors. The only advantage the older men had was that they were naturally used to taking on any job that came along, having never had any assistance from teachers or books.

A case in point came to my attention a short while ago in a shop finishing large marine propeller shafts. The brass liners are about 12 inches diameter, and anywhere from four to six feet long, and after boring out are heated and shrunk on to the shaft. These people were losing the liners, sometimes three or four consecutively, on the same shaft, by reason of the liners developing a crack circumferentially when cool; this cracking they attributed to the material, as they thought a crack caused by a shrinkage strain would be a longitudinal one.

Now in the shop where I served my aprenticeship we were turning out propellor shafts continuously, and I never saw one crack, and this although they were made of common yellow brass, nearly all scrap, while the ones mentioned above which did crack were the 88-10-2 mixture cast of all virgin metal, and subject to analysis.

Investigation showed that both the shaft and the liner were rough turned, and no attempt had been made to get a smooth surface where the liner fitted. Considering that at the temperature at which these liners are shrunk on the shrinkage longitudinally will be around one-eighth inch per foot, or ¾-inch on a six foot liner, it is clear that either the liner must slip along the shaft as it cools, or crack circumferentially as actually happened. Having been used to shrink fits whose length was comparatively short, it did not occur to them that the liners had to shrink in length as well as in diameter, and the solution of their trouble was obviously to turn both shaft and liner smooth enough to allow the liner to slip along the shaft when contracting.

Another Case

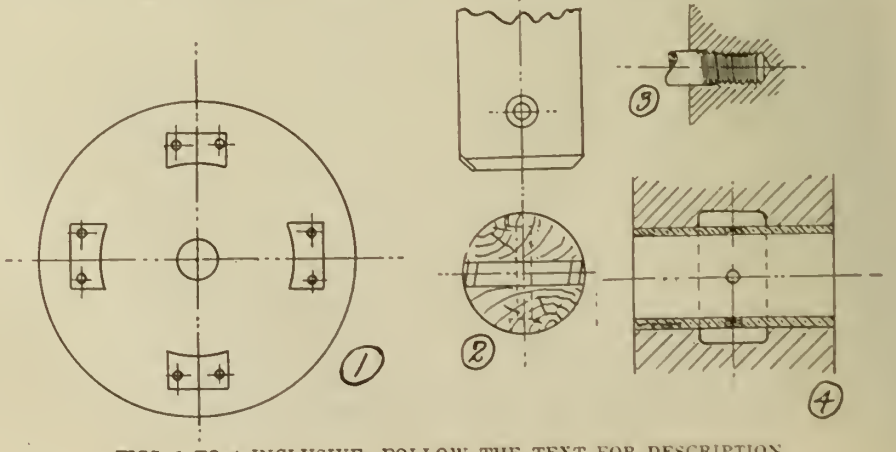
Before mass production reached its present dimensions, it was common practice for the machinist to devise his own jigs, and generally to decide as to whether it was worth while to fix up a jig or not. The practice now seems to be that if no jig is provided the machinist makes no attempt to improvise one. For instance, even the smallest shop will at times get a quantity of wheels, flanges or similar circular castings to bore out, and to true up each individual piece in a chuck is a waste of time, even if only six are required. By taking three or four short pieces of bar and after bolting them to the face plate, bore them out to the diameter of the casting, as shown in Fig. 1, we have a jig which will centre the castings accurately enough for ordinary work, at a trifling expense. The casting is then clamped to the face plate and the time spent in trueing up is eliminated.

For boring out plain solid bearings, when the quantity is too small to warrant the expense of a special jig the best method is to bolt an angle plate to the face plate, at a distance below the centre of the lathe equal to the height from the base of the bearing to the centre of its bore. Also drill holes in the angle plate to match the bolt holes in the base of the bearing, and we are then assured that all the bearings so machined will be alike as to centres.

While on the subject of bearings it should be noted that solid bearings for hand operated, or slow moving gearing, such as chute hoists and the like, where the bearings are bolted to the wood work of the building or structure, should be bored out one-sixteenth of an inch larger than the shaft, to allow for mis-alignment, due to the possible warping of the wood and settlement of the structure. To the man who has not had the operating of such mechanism this may seem like sloppy work, but actual experience dictates this clearance as essential for really satisfactory performance.

A point often overlooked in the machining of gears, bearings, etc., which are called for in the drawing to be faced on one side of the boss only, is that it is not correct to merely machine off enough to clean up the surface. It is necessary that the distance from the centre line of the gear, or of the bearing, to the machined face, must be as shown on the drawing, or the erecting crew will have trouble, and this dimension should be worked to in machining.

When a parallel or taper reamer, of a size not available, is wanted in a hurry, one can be made up very quickly by turning up a piece of flat tool steel, and fastening to it hard wood blocks as shown in Fig. 2. The shank can be made square or tapered to suit the driving medium and a reamer so made will do



FIGS. 1 TO 4 INCLUSIVE—FOLLOW THE TEXT FOR DESCRIPTION.

a surprising amount of work of a high quality before being worn out.

Some Other Ideas

Cases arise occasionally when a stud has to carry its load in shear, and if screwed in in the usual way the area to resist shear is only that at the bottom of the thread, and it is further weakened by the sharpness of the thread, which tends to make it easy to shear off. This can be improved upon by counter-boring the hole about ½-in., as shown in Fig. 3, to the neat diameter of the stud. The stud is then screwed in until the end of its threaded part is at least ¼-inch under the surface, the result being that the solid part of the stud now takes shearing strain.

For heavy pressures or for places where the joint would be hard to get at, if a leak should start, a sure job must be had, and the safe way is to spot face the casting under the nuts and bolt heads, thus getting a greater tensile strain on the bolt with an equal pull on the wrench, due to the lesser friction under the nut, with a smooth surface. The nut and bolt head under these conditions will also give a better support to the flange, against springing under the pressure. When heavy bolts are used, ¾-in. diameter or over, additional safety can be gained by slightly heating the bolts, so that they will shrink after being tightened up by hand.

It would seem that a shaft coupling, shrunk or pressed on a shaft would remain true, after driving the key, but experience shows that the driving of the key will often throw the coupling out of line slightly, and it is good practice to true up the coupling after it has been keyed to the shaft. Cases of hot bearings, in line shafts, otherwise mysterious, may often be traced to the coupling being forced out of true when the key was driven.

Loose pulleys, ring oiling bearings and such, where the inside is cored out to form an oil reservoir, should have the rough surfaces carefully painted over to prevent any of the moulding sand adhering to the surface, afterwards becoming loosened and getting mixed with the oil. A good idea in loose pulleys and rollers is to drill about six holes in the bush and plug them with felt, this will keep the oil from running out of the reservoir, and provide a continuous feed of clean oil to the bearing; the general idea is illustrated in Fig. 4.

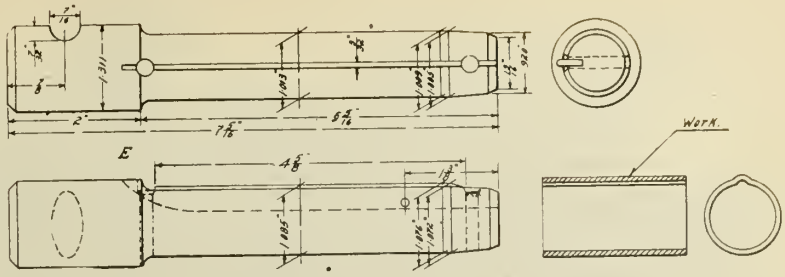


FIG. 1—DETAIL OF THE WORK AND BROACH.

OSCILLATING BROACHING FIXTURE

By "Draughtsman."

THE operation is to broach a piece of drawn brass tubing 2 inches long, 1 inch inside diameter, and 3-32 inch thick, and to form a small fluting running its whole length, as in Fig. 1.

The piece is subsequently punched for an oil hole and then pressed into the end of a wooden connecting rod, thereby forming a bush which cannot turn because of the fluting, which also acts as an oil groove. The operation is accomplished on a press of 3 inch stroke, and the fixture is designed so that one piece is broached and another ejected per stroke.

The upper holder B carries a broach C and a pusher D. The broach, shown in detail, has an inserted blade E held by two pins. The enlarged head butts against the counterbore shoulder, and is prevented from turning by a "half-and-half" pin. The pusher is simply a pin shouldered at its upper end and held by a set-screw. Its body is slightly less in diameter than the brass tube, and its lower end is shouldered and reduced to a short centering taper.

The bolster F has a recess in which rests the hardened die block G. By means of a lever H and handle it can be rotated through 180 degrees, its movement being limited by stop pins J. The dieblock is retained by a steel ring K. The stationary stripper plate L has two bushings, the first one M, under the broach is fluted to suit the work, and resists upward thrust, while N, the one under the pusher, has a plain hole and resists downward thrust. The front part of the stripper is reduced in thickness to give ample room for the operator's fingers. The broach hole in the bolster carries a heavier bushing O to take the thrust of broaching, while a clearance hole P under the pusher communicates with the hole in the bed of the press.

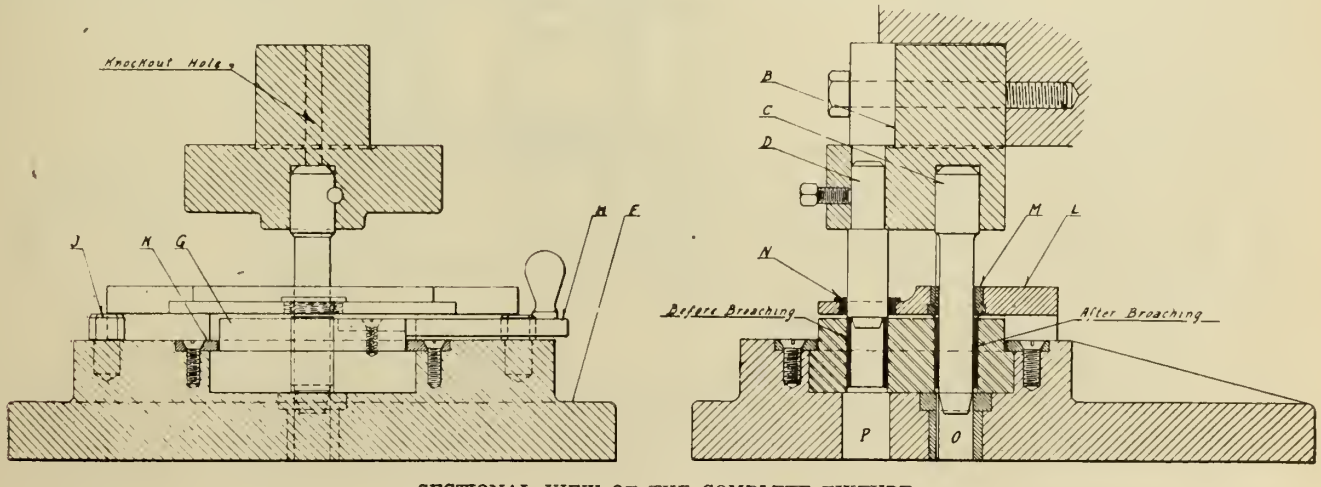
Operation

With the ram up and lever over, say to the right, loosely insert bush No. 1 in the hole under the pusher. Trip the press and the pusher will force the bush into the die-plate.

With the ram up, swing the lever over to the left and insert bush No. 2 under the pusher. Bush No. 1 is now under the broach, which never leaves the stripper. Trip the press and bush No. 1 will be broached while bush No. 2 is pushed into the die plate.

With the ram up again, swing the lever back to the right and insert bush No. 3. Trip the press and bush No. 3 will enter the die plate causing bush No. 1 to be ejected below, while bush No. 2 will be broached. And so on.

An option has been obtained by a New York organization from the School Board, on a site on the north side of Bloor Street, at the head of Church Street, Toronto, and a ten-story private hotel will be built there. The cost is estimated at between $4,000,000 and $4,500,000.



SECTIONAL VIEW OF THE COMPLETE FIXTURE.



Development of 8 Driving Wheel Locomotive

By J. SNOWDEN BELL*

LOCOMOTIVES having eight driving wheels, the latest designs of which exemplify the most generally approved practice in heavy freight and passenger road service, the Mallet and Decapod types being adapted to, and ordinarily used only under exceptional conditions, were not, as a class, the outgrowth of increasing requirements in the operation of railroads, but were introduced at a very early period in their history, dating from some time prior to the year 1825. A review of the progressive steps of improvement that have brought them to their present perfected state will present features which have passed out of general recollection, and may, from a historical standpoint, be found of interest.

Wylam Colliery Railroad, 1825

The first eight driving wheel locomotives of which a record has been found, are those which are described and illustrated in Wood's "Practical Treatise on Railroads," London, 1825, as being then used on the Wylam Colliery Railroad, in England, and are shown in Fig. 1, which is reproduced from Plate VI of the Treatise. The boiler is of the return tube type, and, with the two vertical cylinders, is supported on a wooden frame, which is carried on two independent truck frames, these being fastened to the main frame "by bolts in the middle, which allow a lateral motion in the frames, to conform with the occurrence of curvatures in the line of the road."

Two pairs of driving wheels are fitted in each of the trucks. The piston rods are connected to beams, supported at one end on the main frame, from which connecting rods extend to cranks on the ends of a transverse shaft, located at about the middle of the length of the locomotive, which shaft carries a spur gear, engaging a similar gear on a shaft below it. The latter shaft is geared to the adjacent driving axle of each truck, and these to the other axles, intermediate gears being interposed to effect the rotation of all axles in the same direction, the locomotive thus having no less than eight spur gears for transmitting power from the pistons to the four driving axles.

The dimensions of the locomotives are not given, but from the scale accompanying Plate VI the cylinders appear to be about 8½ inches bore, for 24 inches stroke of pistons; the driving wheels 43 inches diameter; and the boiler 42 inches diameter and 9 feet 9 inches long. These locomotives probably weighed in the neighborhood of 10 tons, which was an extremely heavy weight at their date, and Nicholas Wood, the author of the Treatise, gives the reason for their distribution of weight as follows: (Pp. 155, 156.)

"The railroad on which these engines travel being too weak to support the weight divided on four wheels, recourse was obliged to be made to eight wheels; and this rendered the use of so many cog wheels necessary, to obtain the adhesion of the whole weight of the engine.

"This circumstance adds much to the complication of the engine, which, of course, increases the friction by the multiplicity of cog wheels and other moving parts."

Ross Winans, of Baltimore, Md., who will be remembered as one of the most prominent and successful locomotive builders of his time, obtained, on July 23, 1843, a patent of the United States, No. 3201, for "a new and improved manner of constructing locomotive engines with eight driving wheels," in the specification of which he states that:

"I do not pretend, therefore, to have originated the idea of constructing a locomotive engine with eight driving wheels, but limit my claim to invention to having so brought together, and combined, various known elementary parts of such engines as to have produced one

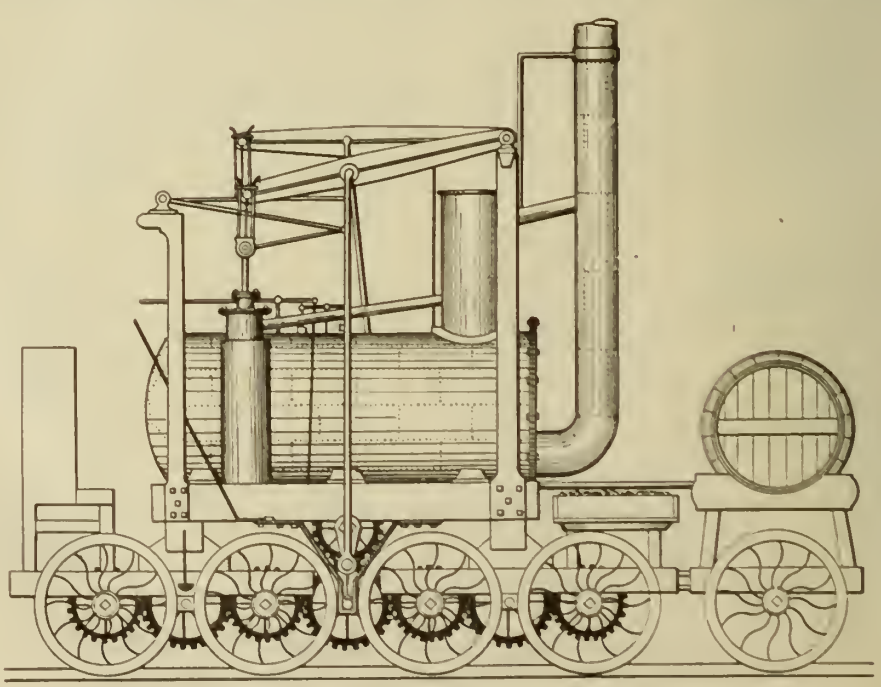


FIG. 1—AN EARLY TYPE OF EIGHT DRIVING WHEEL LOCOMOTIVE.

*From Record No. 189 of the Baldwin Locomotive Works.

which is substantially new, attaining the desired end in a manner more simple and effective than on any of the plans heretofore devised."

As shown in Fig. 2, which is reproduced from the drawing of the Winans' patent, the locomotive of that patent had a vertical boiler and horizontal cylinders, the pistons of which rotated a transverse spur wheel shaft at one end of the engine, which was geared to the nearest driving axle, with which the other three driving axles were coupled by end cranks and side rods. Two spur gears only were used, instead of eight as in the Wylam engines.

Three locomotives of this design were built to the order of Mr. Winans, by M. W. Baldwin, of Philadelphia, for the Western Railroad of Massachusetts, and were completed in April, May and June, 1842. No drawings of these engines are in existence, and it is believed that they were the only locomotives of this type that were built with vertical boilers.

Ross Winans, 1844

The "Report on the Use of Anthracite Coal in Locomotive Engines on the Reading Railroad," made by Geo. W. Whistler, Jr., April 20, 1849, states (p. 23) that "In October of that year, 1844, Ross Winans produced the first successful coal burning engine with a horizontal boiler," and the report further states that 12 of these engines were placed on the Baltimore & Ohio Railroad, between October, 1844, and December, 1846, and that a substantially similar engine was built by the company in May, 1847.

These engines, which were the first eight driving wheel engines on the Baltimore & Ohio Railroad, were known as the "mud diggers," doubtless by reason

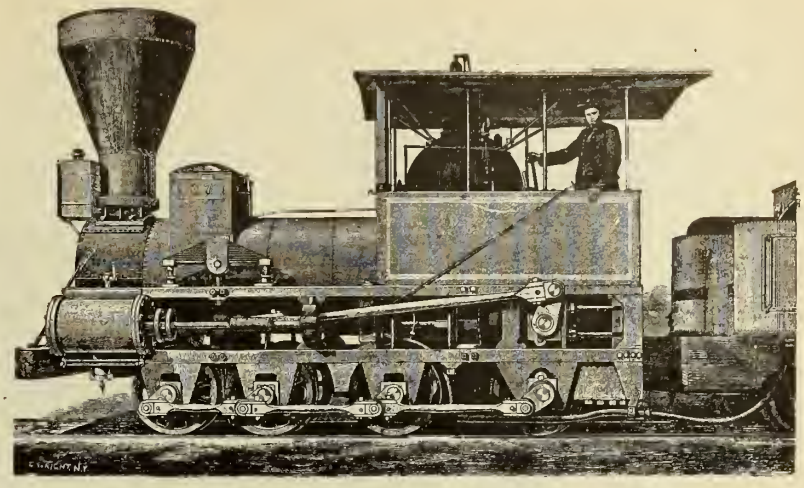


FIG. 3—THIS TYPE OF ENGINE WAS KNOWN AS A MUD DIGGER.

of their action on the then comparatively light superstructure of the road.

As shown in Fig. 3, which is reproduced from a photograph of engine No. 37, made at Mount Clare shops in 1863, the main connecting rods were, as in the three engines of the Western Railroad of Massachusetts before referred to, coupled to cranks on a shaft extending across the frames, in the rear of the boiler, and geared, by spur wheels, to the back driving axle. The four driving axles carried end cranks which were coupled by side rods.

The 12 Winans' engines of the Baltimore & Ohio Railroad, mentioned in Mr. Whistler's report, were of the above construction, and were the "Hercules," No. 33, October, 1844; "Gladiator," No. 34, November, 1844; "Buffalo," No. 35, November, 1844; "Baltimore," No. 36, December, 1844; "Cumberland," No. 37, July, 1845; "Elephant," No. 38, July, 1845; "Opequan," No. 40, July, 1846; "Elk," No. 41, August, 1846; "Catoctin," No. 42, October 1846; "Youghiogheny," No. 43, November, 1846; "Tuscarora," No. 45, December, 1846, and "Allegheny," No. 46, December, 1846. The engine built by the company was the "Mount Clare," No. 49, May, 1847.

These engines weighed 23.5 tons. and had 17 x 24-inch cylinders and 33-inch driving wheels. Some of them were in yard service as late as 1865, and probably for some years afterwards. A number of their cylinders and main connections were used as parts of stationary engines in the shops of the road after their road service was terminated.

M. W. Baldwin, 1846

The first locomotives, of what is now known as the 0-8-0 type, in which the objectionable feature of gearing was eliminated, by coupling the main con-

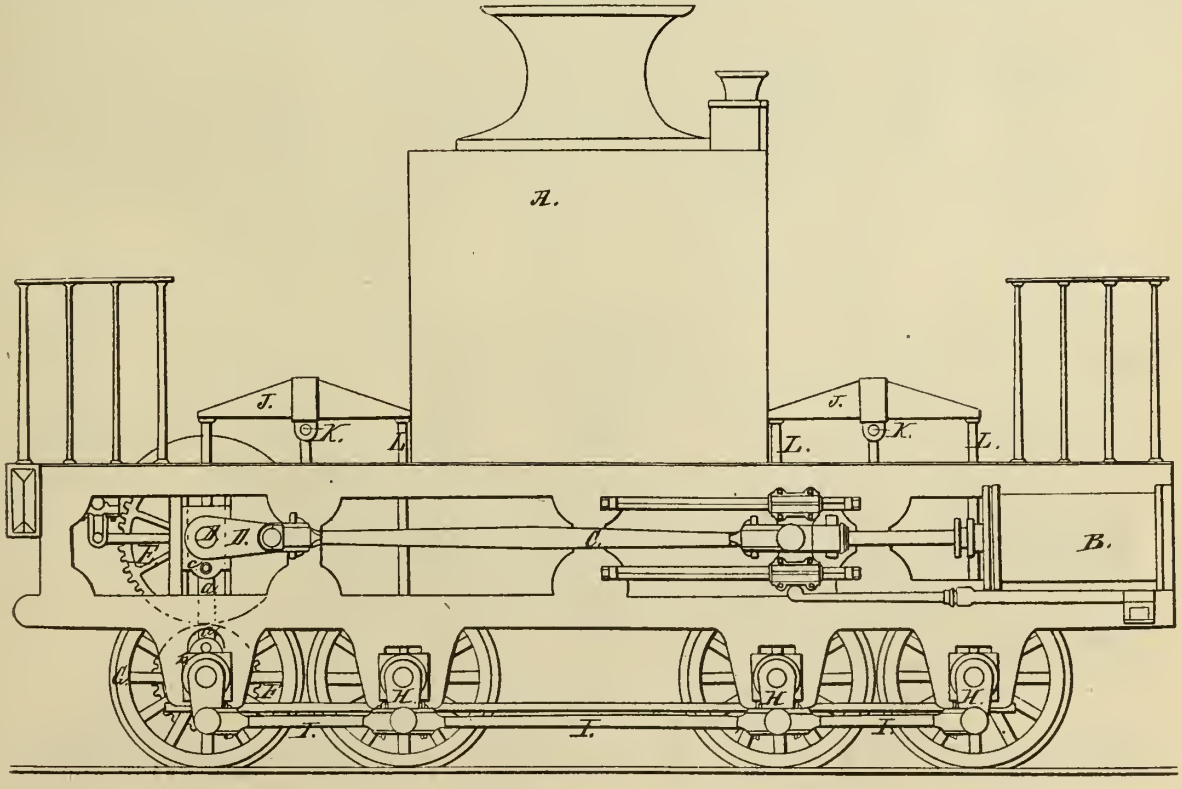


FIG. 2—A REPRODUCTION OF THE WINANS' PATENT.

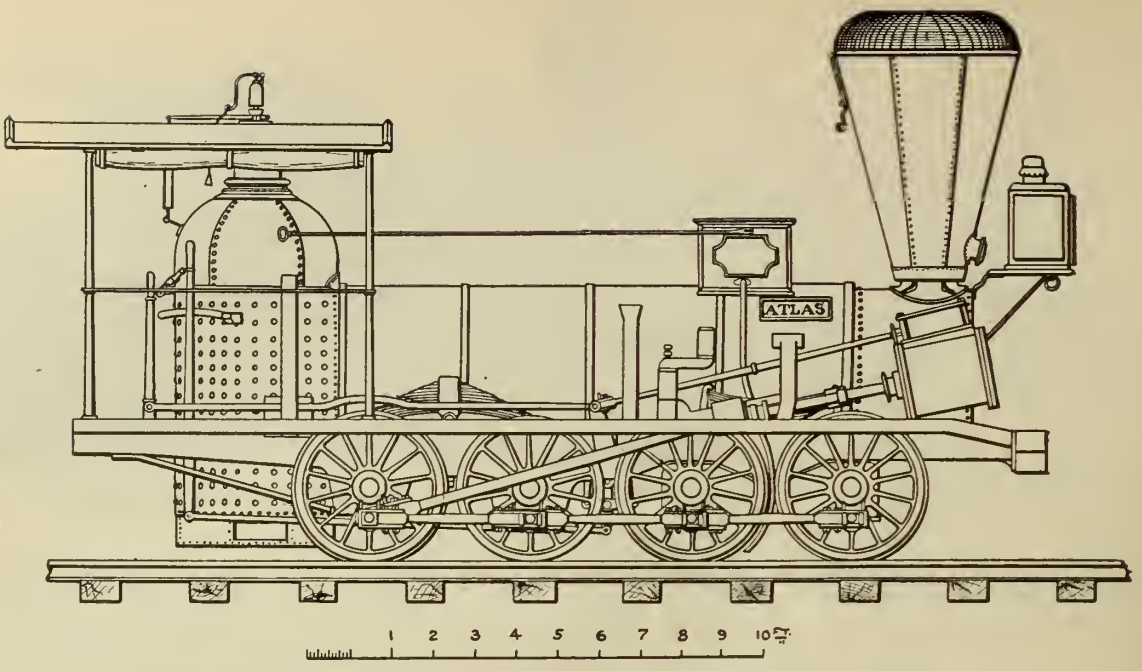


FIG. 4—SHOWING INCLINED CYLINDERS AND DROP HOOK VALVE GEAR.

necting rods directly to the crank pins of the main driving axle, were built by M. W. Baldwin, seventeen of them being constructed in a single order, for the Philadelphia & Reading Railroad, in 1846. Two of these engines, the "Atlas" and the "Hercules" (Fig. 4), which were used in pushing service on the Falls grade, at Philadelphia, weighed 27 tons, and their cylinders were 17¼ x 18 inches and driving wheels 42 inches in diameter. The other engines of the order weighed 22.4 tons, and their cylinders were 15½ x 20 inches, and driving wheels 46 inches in diameter.

The characteristic feature of all of these engines was the very ingenious appliance known as the Baldwin "flexible beam truck," in which the boxes of the first and second axles were fitted in beams, which were articulated independently, to the main frames on opposite sides of the locomotive, by spherical joints. The driving boxes were turned cylindrically and fitted in correspondingly bored pedestals, and the brasses of the front coupling rods were cylindrical and fitted on corresponding pins. The wheels of the third axle had flat or "blind" tires. The engines were thus enabled to pass curves of very short radius. The flexible beam truck is the subject of Mr. Baldwin's patent No. 2759, of August 25, 1842, and the principle of its operation is well and clearly stated by Zerah Colburn, in his treatise "Locomotive Engineering," 1871, p. 85.

All the engines of the first order had inclined cylinders and drop hook valve gear, as shown in Fig. 4. The 15 lighter engines were also fitted with independent cut-off valves, but single main slide valves were applied on the "Atlas" and "Hercules." The fireboxes of the latter engines were small, having only about 8.45 square feet of area and the engines burned wood fuel. The total heating surface was about 1153 square feet, and, on the basis of the evaporative value of the tubes and firebox, the boiler power appears to be in excess of the cylinder requirements. The tractive power of the engines may be estimated at about 10,850 pounds, and it is probable that no engines of greater power had, up to their date, been built. They did efficient service for many years, and a number of them were rebuilt by the railroad company, with wide fireboxes for anthracite fuel, and link motion valve gear.

The general design of the Reading engines continued to be the practice of the Baldwin works, in the 0-8-0 type, until that type was superseded by the addition of a leading truck. In some instances, as in wood burning engines, the firebox was located between the third and fourth axles, instead of behind the rear axle, and the final modification of the design, which was made some time prior to 1854, provided an increase of

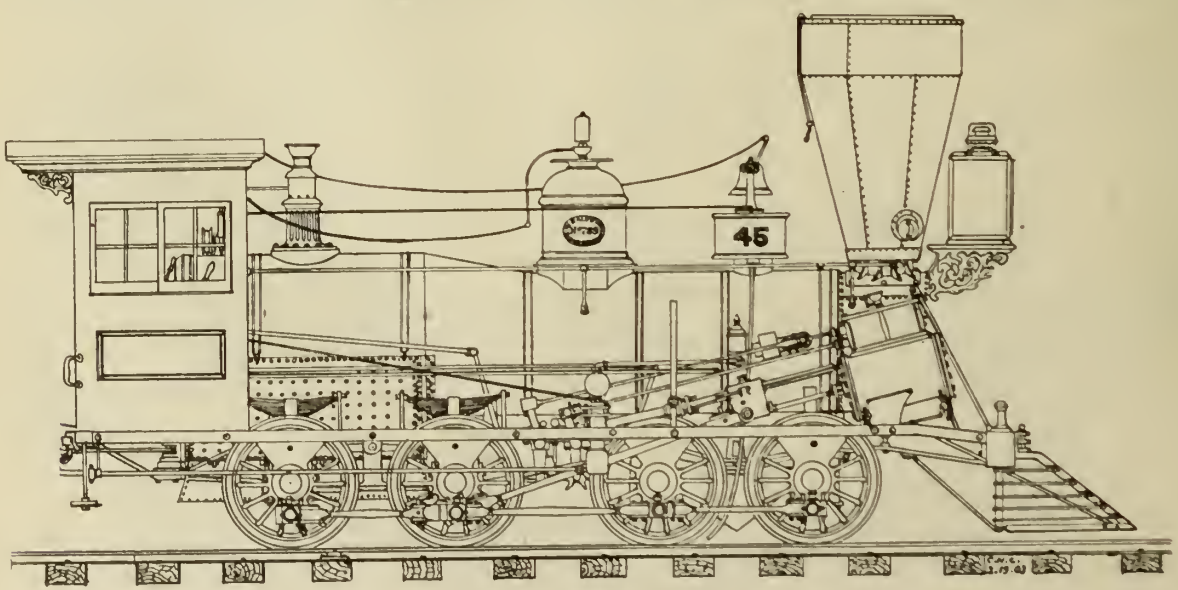


FIG. 5—THIS TYPE WAS BUILT IN 1857.

grate area and firebox surface, by setting the firebox on top of the rear axle. A number of locomotives of this construction were built for various railroads, one of which, No. 45 of the Pennsylvania R.R., built in 1857 is shown in Fig. 5. This engine had 18 x 20-inch cylinders, 42-inch driving wheels, and weighed 63,700 pounds.

Ross Winans, "Camel," 1848

As has been stated by Zerah Colburn, whose eminence as an authority on locomotive engineering is beyond question, the so-called "camel" engine of Ross Winans was, "as a whole, the most peculiar engine in use in the United States. In every detail of construction this engine is alike peculiar, and in the strongest possible contrast with the proportions, arrangement and workmanship of the standard American engine." Its design is quite clearly shown in Fig. 6, which is reproduced from an advertising lithograph issued by Mr. Winans.

The distinctive features of novelty of the camel engines were the following: 1. The use of eight driving wheels, set closely between horizontal cylinders and a long overhung firebox, the width of which was equal to, or greater than, the distance over frames. 2. A firebox having a downwardly and rearwardly inclined top, which was exclusively a water casing, there being no steam room in it. 3. A dome and engineer's cab, placed on the top of the boiler, close to the forward end. 4. An upper chute or pair of chutes, for feeding coal through the top of the firebox. 5. A firebox having no water space on its rear side, which was closed by doors, so as to expose its entire area when desired. 6. The abandonment of crown sheet stay bars, and the substitution of stay bolts connecting the crown sheet with the outer shell. 7. The use of a half stroke cam, as a means for effecting cut off. All these engines were substantially of the same construction, except as to the firebox, of which there were three classes, the short, the medium and the long.

The first engine of the class, the "Camel," No. 55, was placed on the Baltimore & Ohio Railroad in June, 1848, and 112 in all were comprised in the company's equipment. A number were also built for the Philadelphia & Reading, Pennsylvania, Northern Central, Delaware, Lackawanna & Western, and other railroads. Some of them were rebuilt and modified, and many remained in yard service for a long time after more modern equipment took their place in road work.

Ross Winans, "Centipede," 4-8-0 Type, 1856

The first locomotive in which eight driving wheels were combined with a four-wheeled leading truck, and what is now known as the "Mastodon" or 4-8-0 type, was the "Centipede," which was built by Ross Winans in 1856, and sold to the Baltimore & Ohio Railroad in 1863. This engine is of special interest, not merely as being the first of its type, but also by reason of numerous novel and peculiar features of structure which it embodied, and it is greatly to be regretted that no description or drawings of it appear to have been preserved, and, therefore, that it can be described only from the recollection, naturally dimmed by the lapse of years, of the few now living who, like the writer, have seen the engine.

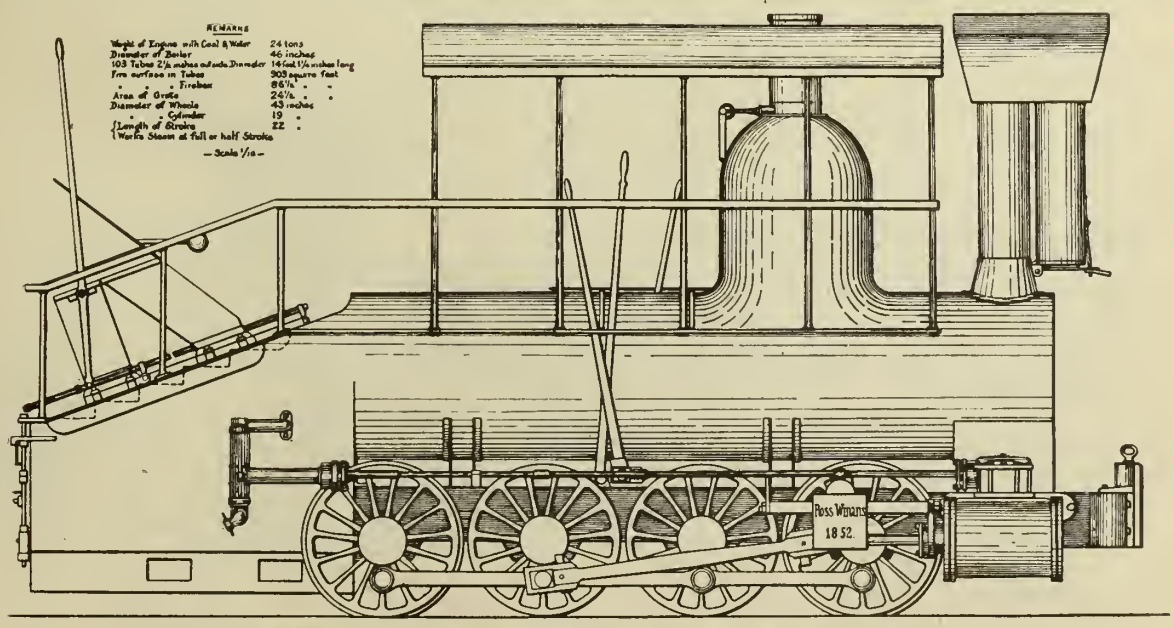
The boiler was of the same form, and about the same size, as those of the camel engines; the cylinders were 22 inches bore and 22 inches stroke; and the driving wheels 43 inches in diameter. The weight was probably not far from 29 tons. The engine had independent cut-off valves, and the cab was located on the front bumper platform, the throttle rod passing through the stack. The bearings of the truck axles extended nearly the entire length between the wheels, and there were other peculiar details which cannot now be remembered.

Comparatively few locomotives of the 4-8-0 type have been built for American railways. Probably the most extensive user of this type is the Norfolk & Western, which in the years 1906 and 1907, placed in service 100 4-8-0 type engines built by The Baldwin Locomotive Works. These were followed, in 1910, by 50 heavier engines of the same type. One of the latter is illustrated by Fig. 7.

These locomotives, as originally built, used saturated steam, and were equipped with Walschaerts valve motion and piston valves. They were of the following dimensions:—weight of engine, 261,100 pounds; weight on driving wheels, 213,200 pounds; cylinders, 24 x 30 inches; driving wheels, 56 inches diameter; boiler, 80 inches diameter; heating surface, 4041 square feet; grate area, 44.7 square feet; boiler pressure, 200 pounds; factor of adhesion, 4.07; maximum tractive power, 52,500 pounds.

Baltimore & Ohio R.R. Co., 1865

With a view to the avoidance of certain structural objections which obtained in the camel engines, as well as to incorporate additional features of improvement, Thatcher Perkins, then master of machinery of the Baltimore & Ohio Railroad, designed a class of locomotives of the 0-8-0 type, which were variously termed the "Perkins' eight



Transportation Engine, adapted for the burning of Anthracite & Bituminous Coal
MANUFACTURED BY
ROSS WINANS
BALTIMORE MD

FIG. 6—THE ROSS WINANS TYPE, TERMED THE MOST PECULIAR ENGINE EVER USED IN THE UNITED STATES.

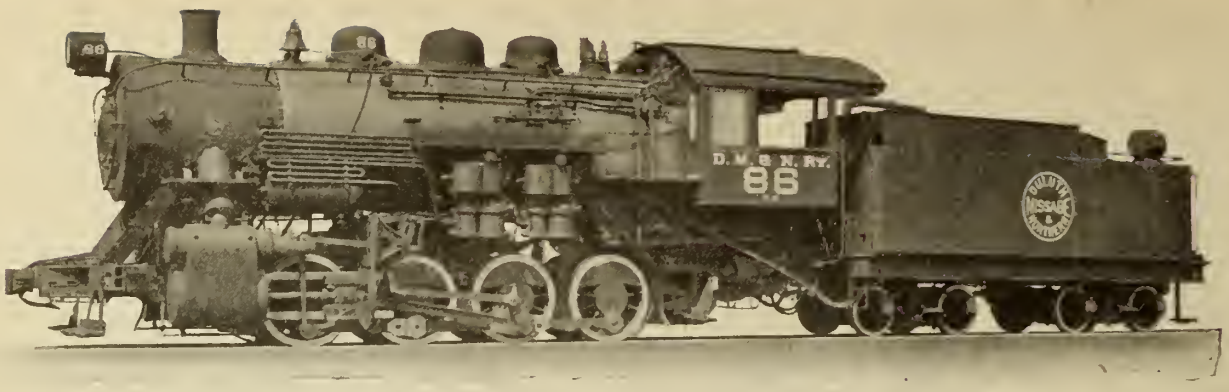


FIG. 9—THIS STYLE ENGINE WAS BUILT IN 1917.

wheel connected engines," the "green backs," and the "Jerseys." These engines are shown in Fig. 8, and 24 of them were built in 1865, two by the company, two by Reaney, Son & Archbold, of Chester, Pa., and 20 by the Grant Locomotive Works, of Paterson, N.J.

The Perkins 0-8-0 engines were similar to the "camels" which they were intended to supersede, only in the particulars of having overhung fireboxes, of the full width over frames, and 43-inch driving wheels, and differed therefrom in the following particulars. Their boilers were larger, being of the straight type, of ⅜-inch iron, 48 and 48¾ inches diameter at alternate rings. Their cylinders were bolted to an intermediate bed or saddle, on which a round smoke box was supported as in present practice, and were originally bored out to 19½ inches, but were designed to be rebored to 20 inches, being 1¼ inches thick.

Their frames, which were of the bar type, were very substantial, weighing about one ton apiece, and having top rails finished to 3¾ x 6 inches. The link motion was of the Gooch type, and a radius of 55 inches was obtained for the links by connections to and from a supplemental rocker shaft. The links were of cast iron, of box form, and weighed 434 pounds each. The draw bar extended through the ash pan, and its front end was coupled to a pin fitted in cross braces bolted to the bottom frame rails. This arrangement, by which the boiler was entirely relieved from strains of draft and buffing, was applied by Mr. Perkins at a much earlier date, and it has, within a few years past, been brought out as a new and original design.

The principal particulars of these engines were as follows: Weight, 65,000 pounds (empty); cylinders, 19½ x 22 inches; boiler, larger diameter, 48¾ inches; thickness, ⅜ inch; pressure, 100 to 110 pounds; 115 flues, No. 12 W. G. 2½ inches outside diameter and 15 feet long; inside firebox, length, 66 inches; width, 42 inches; depth, 57 inches; grate area,, 19.25 square feet; flue-sheet (copper), ⅝ inch; back sheet (copper), ⅜ inch; side sheets (copper for 36½ inches from bottom 3-8 inch; exhaust nozzle (single), 4½ inches. Weight of tender, 23,000 pounds; water capacity, 2140 gallons.

Yard Engines of 0-8-0 Type

The earlier engines of this type were usually relegated to maintenance of way and yard work, when, as they became old, they were replaced by heavier power in road service; but within the last few years engines of this type, of weight and power greatly exceeding the earlier road engines, have been designed for, and advantageously operated in, yard service, where comparatively heavy loads were required to be moved.

Fig. 9 shows an engine of this class, built in June, 1917, by The Baldwin Locomotive Works, for the Duluth, Missabe and Northern Ry., which embodies the latest and most improved practice in the 0-8-0 type, and is also very much larger and more powerful than the average road engine of that type which preceded it.

The weight of this locomotive is 216,000 pounds; cylinders, 24 x 28 inches; driving wheels, 51 inches diameter; heating surface, 2690 square feet; superheater surface, 621 square feet; grate area, 48.2 square feet. The boiler pres-

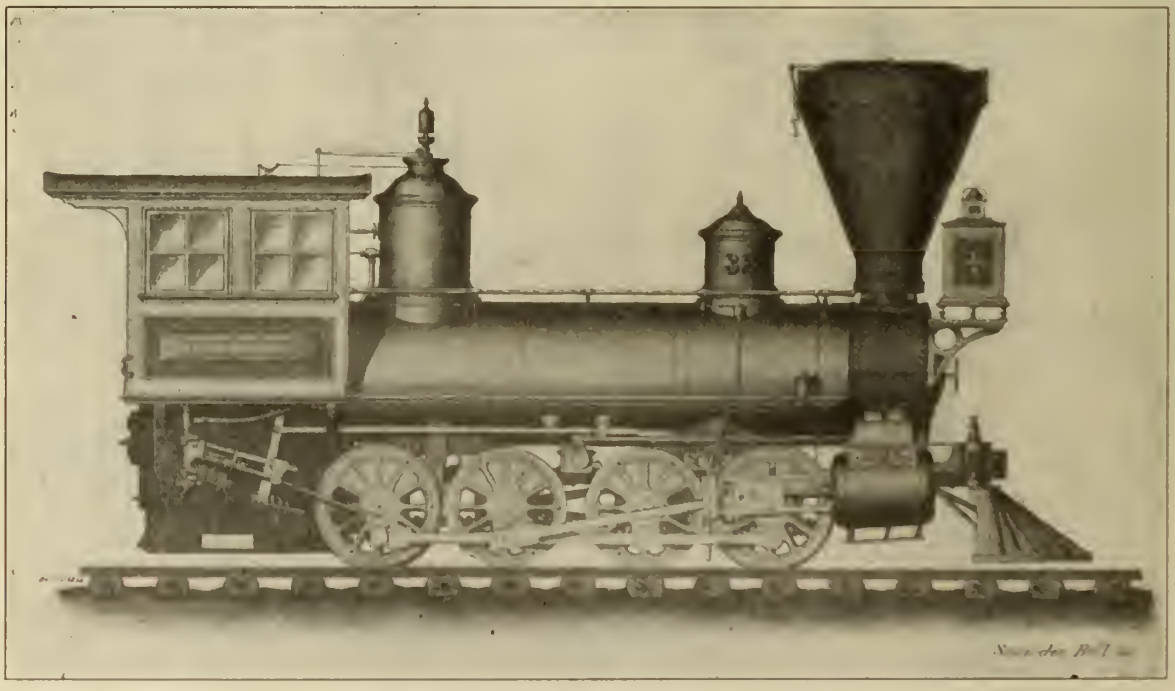


FIG. 8—SHOWING THE PERKINS EIGHT-WHEEL CONNECTED ENGINE.

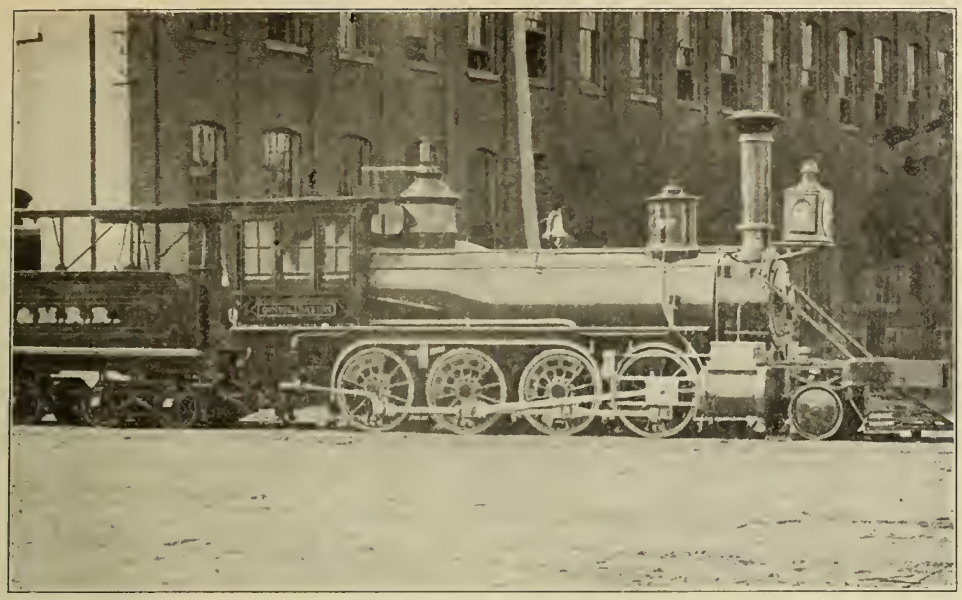


FIG. 11—REFERENCE TO THE TEXT WILL GIVE DETAILS REGARDING THIS P.R.R. TYPE.

sure is 185 pounds; maximum tractive effort, 49,700 pounds, and factor of adhesion, 4.35.

J. P. Laird, 2-8-0 Type, 1864

The next, and most generally adopted, step in the design of the eight driving wheel locomotive, consisted in the application of a two-wheeled leading truck, thereby providing the 2-8-0 (usually termed the "Consolidation") type. This was originated by John P. Laird, then master of machinery of the Pennsylvania R.R., who, in 1864, rebuilt the Baldwin engine No. 98, which was originally of similar construction to engine No. 45 (shown in Fig. 5) and among other changes, put in a two-wheeled leading truck.

As shown in Fig. 10, the rebuild also included an increase of the driving wheel base, and the addition of side tanks and a rear coal bunker; also the fitting of all the driving axles on pedestals rigid with the main frame. The rebuilt engine 98 was used in pusher service on the Allegheny Mountain grade, and in the latter part of 1864 or early part of 1865, another Baldwin engine, No. 97, which was originally similar to No. 45, was rebuilt on the same lines as No. 98.

A. Mitchell, "Consolidation," 1866

In July, 1866, the Baldwin works built to the order of Alexander Mitchell, master mechanic of the Mahanoy division of the Lehigh Valley R.R., the 2-8-0 type locomotive "Consolidation," which has been usually believed to be the first of that type; and prior to the adoption of the present system of classification by wheel arrangement, the type was known by the name of this engine. It was however, as above stated, originated two years previously by John P. Laird, his first locomotive of that type (P.R.R. No. 98) differing from the "Consolidation" in being a tank engine for pusher service, while the latter was a road engine with tender, as shown in Fig. 11.

The weight of the "Consolidation" was 90,000 pounds, of which 80,000 pounds was on the driving wheels; cylinders, 20 x 24 inches; and driving wheels, 48 inches diameter. The design soon became practically the standard for heavy freight service, and up to the present time continues to be generally approved practice, under ordinary conditions.

A NEW BRITISH UNDER-WATER PUMP

In salvage operations, in well-making, and in many kinds of dock and harbour engineering great advantage is gained by using a pump which can work under water. Several types of submersible electric pumps have been designed by British engineers, and the latest type has some special features of interest. The usual practice is to allow the water free access to the stationary part of the motor, thick rubber being used to insulate the electric circuits. In the new invention this part of the motor is cased in a special steel alloy, the casing being filled with oil. This arrangement makes the motor very compact and of high efficiency. By using suitable materials for the casing and pump parts, and a special incorrodible steel alloy in the rotating part of the motor, the pump can be adapted for handling weak acids and other corrosive liquids.

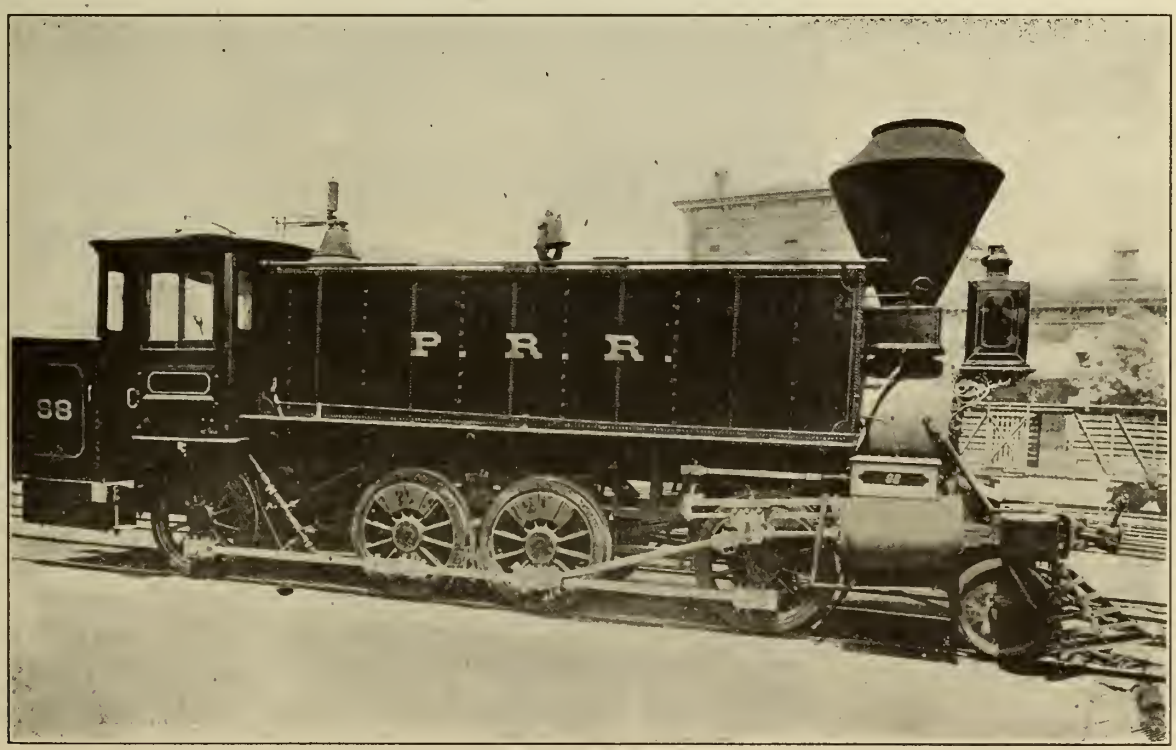


FIG. 10—NOTE THE INCREASED DRIVING WHEEL BASE, AND ADDITION OF OTHER PARTS

Heat Losses in Operation of Electric Furnaces

The Chief Causes of Heat Losses in Electric Furnace Operation Are Described—Various Experiments Were Made to Eliminate These Losses and the Results of Same Are Stated Herein.

By F. HODSON, President Electric Furnace Construction Co.

SOME very interesting data were recently presented before the American Electrical Society, by M. R. Wolfe and V. de Wysocki on the heat losses through electrodes on a 3-electrode 6-ton furnace. The figures given to follow will no doubt surprise many electric furnace users as to the amount and cost of power they are losing through the furnace roof. After a close study of this particular problem for the last four years, the writer is only surprised that the losses recorded were not larger. If the amount of heat in the shape of flame that escapes from most furnace roofs were taken fully into account, the loss would be found to be nearer 30 than 18.7 per cent. The method employed by the authors of the data we referred to above, whilst giving actual heat losses from the electrodes, only gives heat absorbed by the water cooler—a great deal more than this is usually lost.

In considering these heat losses, which perhaps would be better described as through the furnace roof rather than through the electrodes, it might be interesting to consider how the conditions governing the loss of heat and power can be improved.

The Causes

Broadly speaking, the causes are: (1) Heating up of electrodes, due to faulty electrode joint or defective electrode; (2) Heating up of electrode due to imperfect contact or badly designed electrode holders; (3) Heating up of electrode, due to electrode pencilling off at point of arc; (4) Heating up of electrode due to oxygen from the air combining with the carbon of electrode and burning off.

Special care should always be taken in jointing up electrodes—troubles due to this become increasingly worse as the melt proceeds. Good quality electrodes can now be purchased, and it pays to pay even a little higher price for proved electrodes. The design of electrode holder should be carefully considered and changed if undue losses occur. With proper contact, little or no heating should occur here; on our own furnaces we have not found it necessary to install water-cooled holders, looking upon these as an admission of failure to get proper electrical contact.

Pencilling of Electrodes

This is probably the indirect cause of more heat losses than any other feature. It is accentuated in cases where too large a space is left between the electrodes and the cooling ring, or where the furnace doors are not kept properly closed at the bottom or where, as in some cases, the melter has to unduly open his doors to inspect or rabble his molten charge. The air strikes the white-hot electrode and burns away carbon, the hole in the roof acting as a flue draft, and the electrode pencils off, so that the area at the bottom, where the arc is, is often only one-fifth of what the furnace builders have designed to carry the power behind the furnace. The current continues to flow through this restricted area of electrode and its resistance to the excessive current over the smaller area results in the whole electrode heating up instead of going into the arc. This also causes trouble with the joints, with the holders, and on all the outside electrical connections. Sometimes large pieces or flakes of electrodes break off, due to the increased resistance.

With the above facts in mind, our metallurgists have been working for the last five years to try and prevent this pencilling and heating up of electrodes. It was realized early in the investigation that if the flame could be prevented from blazing out at the top that one of the chief causes, viz., pencilling, would be largely overcome. Experiments have been made with over a dozen different types of water cooler and also attempts were made to insert an inert gas under the furnace roof.

As a result of these experiments, Mr. F. W. Brooke, vice-president of our company, has developed a type of electrode cooling ring or electrode economizer, now fitted as standard on all Greaves-Etchells furnaces, that really does prevent this flame and consequent pencil-

(Continued on page 95)



FIG. 1.—VIEW OF FURNACE IN OPERATION.

Would You Like to Receive One of These Scales FREE?

You can easily do so and at the same time add to your store of knowledge by entering our weekly contest of which details are given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

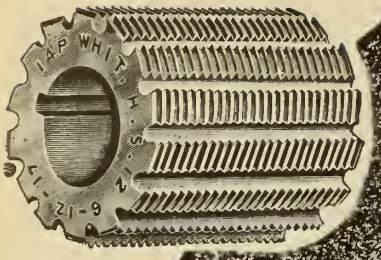
We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

Contest for December 2nd Issue

Contestants are required to write us stating to which advertisements in the advertising section in this number the following references are made:

1. Where to get valuable advice.
2. How to figure the net value of a reamer.
3. Something that can be used with confidence.
4. A material that is said to be ideal for use in the construction of heavy duty machinery.
5. A machine said to be quick and easy of control.
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7. Something that will take larger work and turn out larger production.
8. How to secure something that is erasure proof.
9. How to perform long drilling operations.
10. Something that is said to have a powerful positive drive
11. A product that has been manufactured constantly for 60 years.
12. Something said to be highly endorsed.

Closing Date for This Contest is December 23rd



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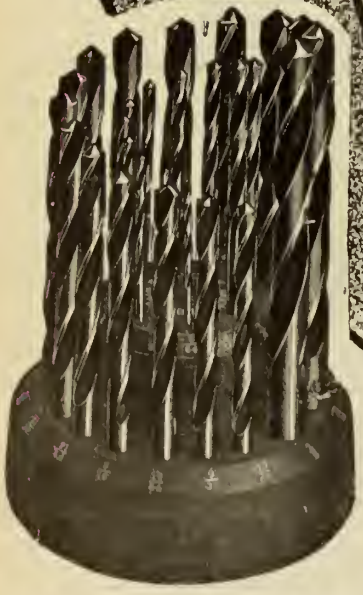
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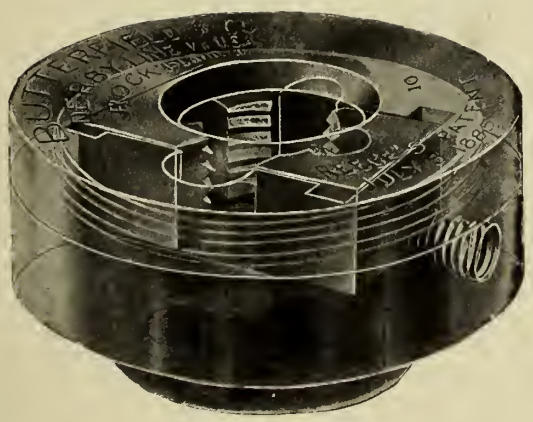
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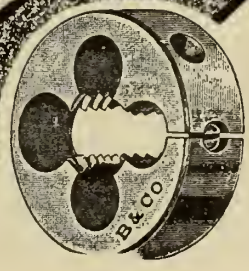
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Used All Over the World



If interested tear out this page and place with letters to be answered.



WELDING AND CUTTING



The Welding of Wrought Iron and Steel

The Equipment and Materials Necessary, the Preparation of the Weld, the Use of the Carbon Electrode and Other Points Are Described

By H. L. UNLAND

THE welding of wrought iron and steel in simple sections by the electric arc welding process presents no serious difficulties. Reasonable care on the part of the operator in keeping the weld clean and in the preparation of the weld will, with ordinary skill in welding, result in a successful weld.

The subject of welding may be divided into three steps:

1. Equipment and materials.
2. Preparation of weld.
3. Welding.

Equipment and Materials

In addition to the equipment and auxiliary apparatus, special jobs render it desirable to have on hand other miscellaneous pieces of equipment.

Odd pieces of carbon block or of copper are of much assistance as dams in holding the molten metal in place. In cases where the weld must be smooth on one side, a piece of copper or carbon is held against the weld and metal filled against it. Iron or steel can be used if care is taken not to weld to it.

In filling a hole the bottom is often closed by holding a plate of carbon or copper against it until sufficient metal is filled in to hold.

Care should be taken to flow the molten metal against the guide pieces and not to allow the arc to play directly on them, otherwise the weld will probably be contaminated by this material, or else the guide piece may be welded solid and cannot be easily removed.

A steel wire scratch brush is used to remove light scale and rust, before commencing to weld if necessary, and also at intervals during the welding, usually when changing electrodes.

For small work the positive lead may be bolted to an iron plate forming the top of a work bench. The work may be set on this bench, the contact being sufficient to carry the current. In many cases a vise mounted on the table will be found desirable. If the work is too large for the table it may be set beside the table and a bar laid across to it. This will provide sufficient current-carrying capacity, provided scale and rust do not entirely prevent contact. The rails in a round house, if bonded, are usually connected to the positive lead, and any car on these tracks may be welded by running only the cable leading to the electrode, the return cable being unnecessary since the current will be carried back through the rails.

A convenient terminal for the positive cable consists of a copper hook of proper size to which the cable is bolted. The terminal may be laid on the work or hooked on a projecting part. It is seldom necessary to actually clamp the return lead to the work unless the metal is thickly covered with scale or dirt, which acts as insulation, in which case it is easier to chip or brush off a clean place for the contact than to use a clamp.

The author of this material occupies a position in the Power and Mining Engineering Department of the General Electric Co., and is well able to speak on the subject. He emphasizes the importance of keeping the work clean, and describes various methods of cleaning the same.

If welding is to be done in a room where other employees are doing other work, screens should be provided around the welding operator. They should be high enough to prevent the light striking a large part of the ceiling since the flicker of this light would probably affect the other workmen. The effect, while probably not injurious, would be irritating. White walls and ceiling should be avoided in a welding room.

Gas burners for preheating, and fire brick, sand, or sheet asbestos for covering, are useful, especially for cast-iron work, which in many cases should be preheated uniformly to a red heat and welded while at this temperature. A receptacle of water is desirable, in which the electrode holder can be cooled when it becomes too hot after continued use.

Some operators feel that gloves are necessary to protect the hands from the arc. In many cases, however, operators find gloves to be in the way, especially when working with the metallic electrode. If desired, however, any leather or cloth glove will give sufficient protection to the skin of the hands which is much less sensitive than the skin on other parts of the body. The arms, neck, and face should, however, be covered, since exposure of these parts will probably result in burns similar to sunburn, which, while painful, are not serious.

The Flux

It is the experience of a great majority of welders that flux of any kind is unnecessary in welding, and further, that it is a source of danger in that there is liability of contaminating the weld. If the work is kept clean by brushing at frequent intervals and ordinary care is taken in the operation of the arc a good weld can be made without flux and if these attentions are lacking, flux will not make a good weld.

Preparation of Weld

Metal that is clean is much more likely to make a good, strong weld. Scale, rust, grease, soot, and foreign matter will contaminate the weld and such inclusions necessarily weaken it or else make it hard. Impurities may also make the metal porous and spongy, due to liberation of gas. Pieces of foreign matter may prevent the molten metal filling all parts of the weld and cause cavities.

Various methods for cleaning are in use—pickling for small parts, washing with gasoline or lye, boiling with lye, sand blasting, chiseling, scratch brush, ing etc., the method depending on the local conditions.

Preparatory to welding locomotive tubes to the sheets, it is sometimes advantageous to send the locomotive out on a run to burn off the grease and then clean off the oxide and soot by sand blast. Another method is to heat the boiler to normal by steam pressure and then clean by sand blasting or scratch brushing.

In welding heavy sections where it is necessary to deposit several layers of metal, the surface of the preceding layer should always be cleaned before starting the next.

For long seams the edges should be $\frac{1}{8}$ inch apart at the end where the weld is started, and at the far end the space should be $\frac{1}{8}$ inch plus $1\frac{1}{2}$ per cent. of

the length. This takes care of the expansion of the metal in the sheet and also of the contraction of the metal in the weld as it cools.

Another method of reducing expansion is to put in short sections at intervals, welding in one layer at a time, starting at the centre and working alternately toward either end. Then put one layer in the open sections, and continue in the same way till the weld is completed. The welded section of any layer should not match those in the layer below or above, the joints being broken as in laying brick work.

The welding of complicated shapes such as flywheels and some castings may require preheating at certain points to produce initial expansion which will be overcome as the weld cools. In some cases the entire piece must be preheated and in some cases after welding the whole piece must be annealed. This is sometimes done by heating the piece uniformly and then covering it with sand-asbestos, etc., and allowing it to cool slowly.

In welding cracks in plates, forgings, or castings the crack should be chiseled out to get a good bevel entirely through the plate with ⅛ to 3-16 in. clear opening on the back or to the bottom of the crack in castings or forgings. In boiler work ½ inch holes are sometimes drilled well beyond the ends of the crack and the crack chiseled, beveled, and welded.

Welding With the Metallic Electrode

The arc should be kept short, not over ⅛ inch in length.

The current should not be greater than those indicated in the table for the electrode diameter. Excessive current causes burnt or porous metal to be deposited.

The arc should be kept constant in length to insure uniformity in the metal deposited.

In welding a seam the electrode should be moved in a zig-zag or circular path advancing along the seam. The metal will adhere only to the surface of the work actually played on by the arc so care must be used to bring the arc in contact with the whole surface to be welded.

Be sure the electrode is connected to the negative terminal. If the polarity is reversed the arc will be more difficult to maintain and the deposited metal will not be as good as it should be.

In starting the arc the electrode should be just touched to the work and withdrawn immediately to the required distance. If the electrode is held too long in contact it will weld to the work, causing some delay in freeing it and starting over.

In welding be sure that the arc plays over the entire surface of the joint. The metal of the work is fused by the direct impact of the arc and if molten metal merely runs ahead of the arc over the solid metal of the work, it will not result in a weld.

The metallic electrode used is generally from 14 to 18 inches long. It may be gripped in the holder, either at one end or in the middle as required by the skill of the operator or the nature of the work.

The operation of welding overhead is the same as in normal welding. The difficulty largely lies in holding the electrode steady in the cramped position usually required. If the arc length is kept constantly short the metal will be successfully deposited, and practice is required to accomplish this. The appearance of an overhead weld is sometimes marred by drops of metal projecting or by uneven thickness of the deposited metal, but this can be overcome by proper manipulation of the electrode. A rest for the arm will sometimes assist the operator to hold the electrode steady.

Use of the Carbon Electrode

The holder should grip the electrode from 4 to 5 inches from the end. The electrode should for ordinary work be tapered to a blunt point at the working end to keep the arc from wandering over the end of the electrode. As the electrode burns away with use, the holder is moved back along the electrode to keep length of working carbon constant. The burning away of the electrode will tend to keep the taper approximately constant.

The arc is struck in the same manner as with the metallic electrode, but a longer arc should be used, from 1 to 1½ inches is the average. The arc should not be too short when welding or depositing metal as there is danger of depositing carbon in the weld with the probability of a hard weld resulting. In cutting or melting off metal, the arc should be kept short, about ½ inch being an average length.

To cut (for which purpose the carbon electrode must be used) the arc is operated like a gas torch. It is held in one place long enough to fuse the metal and allow it to run off. For thin plates laid flat a hole is melted through by holding the arc on one spot, then the electrode is slowly advanced along the desired line, the molten metal dropping out below. For thick pieces, such as shafts, castings, etc., it is desirable to start at the top on one edge and work down, allowing the molten metal to run down through the cut. It is often necessary to follow the molten metal down with the arc to keep it melted until it runs off.

The width of the cut will depend on the size of the electrode used and on the skill of the operator in keeping to a straight line. The cut will be slightly wider than the diameter of the electrode in order to allow the arc to be played on the bottom of the cut, and it will be wider for thick sections than for thin ones. The edges of the cut will not be smooth, due to the masses of the molten metal not running away and also to the fact that the arc will tend to jump from one point to another and cause an uneven cut.

To deposit metal with the carbon electrode, the arc is struck as above, but is not held in one place long enough to melt through. A pool of molten metal is established and a melting rod of metal is fed into the arc and melted down on the work. It should all be heated thoroughly to insure complete union before more metal is added.

Since heavier current can be used with the carbon electrode than with the metallic, faster work can be done in depositing metal. The quality of the weld is not quite so good, however, as when the metallic electrode is used. However, for filling holes in castings, building up worn spots, etc., the carbon weld is satisfactory and should be used.

Due to the high temperature and large amounts of heat liberated when using the carbon electrode, the electrode holder is liable to become very hot and under some conditions to melt away at the end. When the holder begins to get hot it should be plunged in a receptacle of water kept conveniently near the operator.

Cutting speed with the carbon electrode for various values of currents strengths and thicknesses of material will be approximately in accordance with the curves shown in Fig. .

Cast Iron Welding

This metal, due to its properties, is unsatisfactory for welding by any method. Its low strength and brittleness causes it to break from expansion and contraction strains unless precautions are taken, and even then a successful weld cannot be assured.

Pieces of simple cross section and heavy pieces present much less difficulty than complicated shapes, but due to the undependable nature of cast iron care should be used in all cases.

The experience and skill of the operator are large factors in determining whether or not a given weld will be successful.

By experimenting, a number of operators have learned to weld copper to copper, copper to brass and steel, and bronze to bronze, as well as Monel metal, high-speed steel and Stellite. The special uses are rather limited in their application and the methods vary, so it is recommended that each operator experiment along the lines suggested by his experience.

Steel Plant in B. C.—Incorporation of the Coast Range Steel, Limited, with a capital of $15,000,000 and controlled by British capital, was announced at Vancouver. It is the intention of the company to create an iron and steel plant with blast furnaces on the lower mainland of British Columbia. **Plans of the** company provide for the ultimate expenditure of $50,000,000 in the establishment of a great iron and steel industry, and it is the intention to start active construction within six months. Engineers have been in the province for two months making a survey of the situation. Vancouver men named directors are H. J. Landahl, Fred T. Congdon, J. D. Kearns, John Steta and Major Montague Moore. The provincial government has approved the project and will pay a bounty per ton on pig iron production.



DEVELOPMENTS IN SHOP EQUIPMENT



AUTOMATIC CHUCKING AND TURNING MACHINE

A new automatic chucking and turning machine, termed the 8B, has been developed by the Potter & Johnston Machine Company, Pawtucket, R.I. This machine is built with a geared automatic change speed head, and the spindle-driving mechanism is all contained in the headstock, which is of unit construction. The machines are heavy, powerful, and accurate, well suited to the manufacturing of multiple parts. The drive is by a single pulley transmitting 20 h.p.

Four combinations of six automatic variations of speed are available, giving twenty-four spindle speeds in geometric progression from 6 r.p.m. to 92.5 r.p.m. Any one of these combinations may be instantly obtained by levers conveniently located on the headstock. The gearing for driving the spindle is self-contained within the headstock, all gears running in oil, which is pumped through all bearings. A gear on the spindle takes care of the higher spindle speeds, while the lower ones are taken care of by a gear fastened to the chuck or faceplate.

The feed gearing is driven from the spindle. There are seven combinations of three automatic variations of feed, making a total of 21 feeds from .005 in. to .125 in. per revolution of the spindle. By changing one train of gears conveniently located on the outside of the machine the range of feeds may be doubled. The hand changes for the feeds are obtained by means of tumbler levers, conveniently located at the front of the machine. The ratio of the second feed to the first feed is constant. The third feed is independent of the first two and any desired combination may be obtained. The changes obtainable on the machine give the proper lead for cutting from twenty to four threads per inch, using automatic collapsing taps or automatic opening die heads. Any one of the three feeds can be obtained automatically at any time. The feeds are independent of the high constant speed for idle movements of the turret slide while withdrawing, revolving and advancing the tools to the point of cutting.

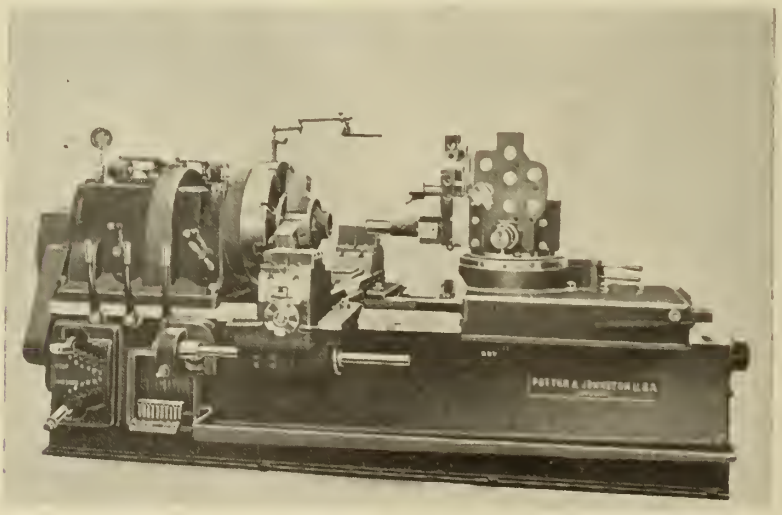
The cross slide is provided with front and rear blocks and two pairs of tool posts are furnished with each machine. The front and rear cross slide operate independently by screw feed, having a feed of 10 in. and can be arranged to feed into the work at any predetermined time, and at any desired relation. one to the other. The turret slide is of rugged construction and travels on ways so designed that all wear will be even and will not affect the accuracy of the machine. The turret slide has a 28-in. feed and no allowance needs to be made for revolving as the turret revolves at the extreme end of its travel. It has 13-in. longitudinal adjustment by means of a hand crank and is securely clamped in any desired position by three bolts, besides being located by the adjusting screw.



REAR VIEW OF THE MACHINE.

The turret has four stations upon which tools may be mounted, and with each machine an outfit of turret-turning tool holders, stems and cutters is furnished. Turrets with five or six faces may be furnished if desired. The turret is revolved by power through an intermittent pinion and gear and is so designed as to give an easy stop and start, the turret being stopped when the lock bolt engages, thus removing any shock from the lock bolt. It is clamped into position by a powerful binder working on the largest diameter of the turret seat. Levers are conveniently placed to release the binder and lock the bolt so that the turret can be revolved by hand. Both cross and turret slides are adjusted in relation to each other by conveniently-placed clutches.

All operation of the speed clutches, feed and quick return clutches is accomplished by a patented method operated by dogs located on the dog wheel or



FRONT VIEW OF THE MACHINE.

drum. This method gives instantaneous movement to the clutches and enables the feed, speed and quick return to begin at exactly the same place each time. An oil pump and piping and oil arrangement through the turret are furnished on machines handling material requiring a lubricant. A 24-inch three-jaw geared scroll chuck regularly accompanies the machine and is furnished with standard set of jaws and wrench. The chuck is provided with pilot bushings to receive pilot bars for supporting the tools during the cutting operation.

A swing of 35 inches is possible over the machine bed and 24 inches over the cross-slide. The travel of the cross-slide (front and rear separate) is 10 inches. A 15 h.p. motor is required to drive the machine, when motor driven.

NEW REINFORCED BEARING

The Lang Manufacturing Co., Ltd., Guelph, Canada, have placed on the market a bearing of most unusual design. This bearing is known as the Ridsdale reinforced bearing, and is of course covered by patents. It is a well known fact that the efficiency of your machinery depends to a great extent upon the bearings used, and the makers of this new bearing state that their patented bearing was first used in a case where a certain style bearing had given trouble for years.

Briefly, the idea is this: A spring or spiral made of a certain alloy is placed in the bearing cap or housing. Babbitt is next poured into the bearing in the usual manner, but in this case the babbitt is merely a holder of the reinforcements. These are shown at Figs. 1 and 2. At Fig. 2 is depicted the reinforcements in place, and held securely by the babbitt.

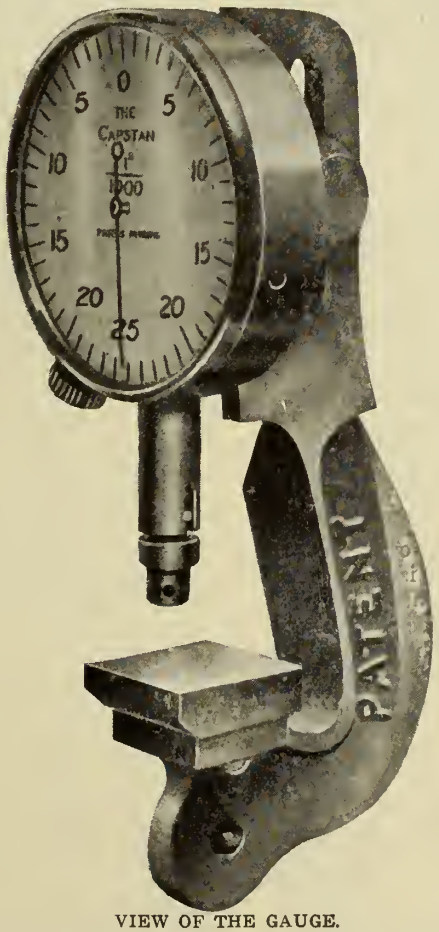
The big claim for this bearing is that there are no hard spots in such construction, also that even the cheapest grade of babbitt can be used with good results. The wear comes on the reinforcement and not on the babbitt itself. In fact in some cases the babbitt, if of a proper grade, can act as a lubricant. The makers also claim that it can be used in any bearing including those where the speed and pressure is extreme.

They state that this bearing has a tensile strength of 36,000 pounds per square inch against a much lower figure for babbitt only. They also claim that its resistance to crushing strain is much greater. Its resistance to heat is also a large factor. Instances have been cited where this type of bearing has run for some considerable time without a drop of oil.

Summarized, they claim as follows: This type bearing requires less attention and can use a cheap grade of babbitt as a binder. It requires practically no rebabbitting and will stand under endurance tests to prove that it will not heat up and seize.

PATENT DIAL GAUGE

The Albert Herbert Ltd.. 1-3 Jarvis Street, Toronto, have supplied us with the details of a patent "Capstan" dial



VIEW OF THE GAUGE.

gauge which they have placed on the market. This gauge is shown in the accompanying illustration and the makers claim for it the following:

The gauge is said to fill the requirements for an accurate, speedy and economical method of testing the accuracy of production. It is used for alignment tests in machine construction, for testing finished parts, for testing concentricity of finished surfaces, and for setting up lathe, planer, milling, or other machine work.

The Capstan head screw, which is fitted to the spindle, is threaded 100 to the inch and is used in setting the hand of the gauge to zero on the test piece. The zero is thus kept always in one position —the top of the dial gauge. This is a great improvement as with most gauges it is necessary to turn the entire dial round for this purpose. This feature eliminates the possibility of the operator, by accident or out of curiosity, altering the adjustment, as the Capstan head screw must be deliberately turned by means of a tommy pin.

The push pin is conveniently placed and is used to lift the spindle or plunger above the part to be tested and allow it to gently descend on the work at one constant pressure—thus eliminating the personal touch. No downward pressure on the work can be given by the operator.

An adjusting screw is used for setting the tolerance to be allowed on the piece tested by simply rotating the knurled head of the screw. For example, after adjusting the screw to bring the hand to the zero mark on the sample or test piece on which a tolerance of say .002-inch high and low is allowed. The screw is rotated to bring the hand two divisions of the dial on the low side of zero. Thus set, any work passed under the gauge would read between the tolerance and two divisions on the left or high side of the zero mark. As the spindle thus has only a movement of .004 the speed in which work is tested is limited only by the operator. The push pin in such an instance is not used.

The dial, as can be noted, is mounted on a base. Various sizes and styles of bases can be provided if desired, and if required metric dials can be procured.

SIMPLE WAGON TIPPER

Many devices, some operated by hand and some by power, have been invented to "tip" a wagon so as to empty it of its contents. One of the most interesting of these devices, worked by hydraulic power, has recently been demonstrated by a leading British firm. The engine of the wagon drives two hydraulic rams, which raise the body and clear it of its load within half a minute. The whole operation is carried out by moving a single lever, this action being performed by the driver without moving from his seat.



THESE VIEWS SHOW NOT ONLY THE BEARINGS THEMSELVES, BUT THE REINFORCEMENTS.

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Mechanical Accuracy

TAKE a hair from your head (the average is about 2½ thousandths of an inch in thickness) and if you could split that hair into ten strands of uniform dimensions, just one of those strands would give a fair conception of the closeness to a mean standard prescribed in more than 300 operations on our car.

"Our work calls for more than 5,000 operations in which the deviation from a mean standard is not permitted to exceed the one one-thousandth of an inch; more than 1,200 in which it is not permitted to exceed a half one one-thousandth, and more than 300 in which it is not permitted to exceed a quarter of a thousandth."

These statements appeared recently in a wide advertising campaign carried out in various national magazines, and were prepared to appeal to mechanical men in general.

Can you imagine such technical copy reaching the columns of popular magazines, even ten years ago?

It is only another proof that this is becoming more and more a mechanical age and that things are changing for the better.

Why are the limits held so close? Simply to obtain accuracy and an interchangeable product. We owe a great deal to the automotive industry in this respect, for they have been largely responsible for our seeking after interchangeability.

Working to fine limits became common practice in Canada during the days of the shell shop. We hear much of the shell-buster-funny chap no doubt. But we don't hear so much about many mechanics who had never measured anything much closer than a sixteenth.

Memory recalls one chap who used to carry a brass rule in his overalls pocket. He could work to sixteenths all right. The question of shells was put up to him and after a study of the required standards he explained that it was out of the question—it couldn't be done in his shop.

What happened? Simply that in a few months he was working in thousandths of inches and turning out a good shell.

Fine limits indicates high class machine shop and tool room practice, as well as excellence of design. Canadian shops should never drop from these standards of mechanical superiority.

Oil Versus Coal

REPORTS from Vancouver state that on account of the oil shortage, oil-burning equipment in boats and locomotives is being taken out and replaced by coal burners.

There is something in this move that may cause a number of very careful students to make one of those "I-told-you-so" remarks. For some time the view has been held that oil-burning equipment was being boomed out of all proportion—that it could never live up to all the advance notices that were being put up for it.

There is a shortage of oil, so marked in fact that it is not possible to secure the 70,000 barrels daily the Canadian Pacific requires.

There must be fuel for the automobiles, joy-riders and others, no matter if there is no fuel for locomotive and steamships.

Many a firm that has spent its good money in perfecting coal-burning apparatus could hardly be blamed for getting a little hot under the collar by the booming that has accompanied every move made by the oil burners.

The oil burning type has many advantages; it is easier to operate; it gives almost a maximum heat right at the start.

But when there is no fuel oil to be had, or when it is in very limited quantities, what then?

The oil burning equipment is desirable on railroads that run through wooded sections, for the foot-hill country of British Columbia, Oregon and other coast territory can bear gaunt testimony of the way in which the old belching locomotive used to strew its live coals on dry material along the right-of-way.

It is an expensive proposition changing over from oil to coal burning equipment. For a locomotive the cost might be from $10,000 to $12,000, while a fair-sized steamer of the ocean-going sort could hardly be altered for less than $50,000 or $60,000.

The coal burner will be with us for some days, and the part of wisdom is to use every possible means devised and improved for getting as much energy as possible out of every ton of coal burned.

The oil burner will be here, too. There is plenty of room for them both.

One Optimist in Business

THE remarks uttered by Lord Leverhulme at the recent opening of the extension of the Toronto plant come as a tonic at this particular time. So many men are preaching hard times, bad outlook, country going to the dogs, etc., that to hear a man who refuses to believe anything of the kind is refreshing. When this man is a practical, successful business man, who can back up his ideas with his money, and is doing so, his opinions are entitled to a hearing. Lord Leverhulme thinks that it would be a backward step to lower wages at the present time, and he is undoubtedly right in the main. To lower wages at the same time that the cost of living is about to be lowered brings the whole situation back to where it was when costs and wages were at their highest. It comes back to the old story, as the speaker emphasized strongly, that maximum production will support itself, by creating a demand, and giving a high wage to those engaged in industry. Of course maximum production depends entirely on the attitude of labor, and in this connection it is noted by some observers that in some shops where men have been laid off, the production of those remaining shows a very favorable increase. The orgy of extravagance, high living, and a false standard generally is passing away, and it is a good thing for us that it is. That there will inevitably be some distress before times are normal again is also, unfortunately, true. If employers generally are imbued with some of the spirit of Lord Leverhulme, and employees willing to live up to their part of the contract, there will be the minimum of distress, and the speediest readjustment.

A Piece of Good Advice

WHEN Mr. Lloyd Harris told the business men of Canada not to depend too much on the Government, he spoke words of wisdom. We do not mean by this the present Government, the past Government, or the future Government in particular, but Government in general as an institution. A government is after all only a collection of ordinary men, who have attained prominence and position sometimes through merit, and sometimes through the fact that having no particular ability, they can be useful to the stronger men in the Government that have. These several men, whatever their abilities, upon attaining place, have their whole outlook on affairs tainted with the view of the office holder, whose primary object is to retain office, and do what he can for the country next. It is obvious that it is vain to look to such an institution for leadership in any vital trade or business development. In fact, any country which depends on its Government to advance its business interests is usually disappointed. It is the enterprise and daring of the individual trader that extends trade, and although a Government can carry out the wishes of the business community to a greater or less extent, it is very rarely that they suggest anything. Generally speaking, Government intervention in matters of business is usually attended with loss and inconvenience to those in the business, as has been abundantly shown in Great Britain by the Government control of shipping. Probably the only exception of note was Germany before the war, but it must be remembered that there they had no representative Government in the sense that we have. Therefore, they had men in the various departments of the Government, who were specialists, and not politicians. The Government holds about the same position in relation to the country that a chief office clerk or office manager does to a big corporation, and should not try to overstep that mark.

Strength of Materials

OUR knowledge of materials, particularly metals, has increased to a great extent within the past few years, but according to Professor F. C. Jenkins, president of the Engineering Section of the British Association, we are, as yet, only on the threshold of that complete knowledge which is essential before we can really tell the cause of a failure, or provide with certainty against accidents.

He states as follows: surely an engineer should be able to say whether a cylinder is safe without dropping it from the roof or rolling it down the front doorstep to see if it breaks. The time has come when the fundamental data on which the engineering theories of the strength and suitability of materials are based require thorough overhauling and revision.

When one considers the matter carefully, the professor is not far from wrong. Judging from some of the formulae we have seen, it would be a much better plan to drop the part under discussion and see if it would break, rather than try to figure out the theoretical chances of its proving too weak.

This condition should not exist, and if sufficient research work is made in this particular field, there is no reason why the formulae can not be simplified to a great extent. We should not have to depend on actual physical tests, but should be able to figure with certainty the strength of our various materials.

Cases exist where theoretical tests alone would not suffice. For example, suppose some structure is being built on which life depends. In such a case both theoretical and physical tests are made. Every boiler must undergo a water test before being fit for use, the various members of a bridge must be tested for their physical properties, and so on.

These precautions are essential with all due respect to theory, because defects can, and do, occur in process of manufacture. Theory does not allow for such defects, therefore they must be checked up by physical tests.

A great need exists, however, of our present formulae being simplified. Here is a chance for the heads of our colleges. Let them concentrate on the task, for by so doing they will be rendering a real service to the machine tool industry.

Can We Harness Radium

IT is a well-known fact that matter is composed of infinitely small particles, called atoms, but have we any conception of the internal structure of an atom? Professor McLellan, F.R.S.O.B.E., in speaking on this subject quotes as follows: "The difficulty of investigating atomic structure might be realized from the fact that if the atoms contained in a litre box of bird-shot were enlarged to the size of the shot, they would cover the entire surface of the earth to a depth of eight inches."

The discovery of electrical elements had greatly facilitated atomic research—the positive element being the nucleus of the atom around which varying numbers of negative electrical elements called electrons perpetually revolve. The study of radium emotions, however, had been the most important source of the accepted atomic theory.

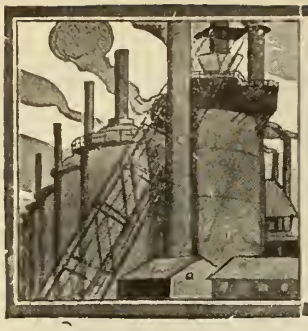
Radium had been formed at an early stage of cosmic evolution from the condensation of highly energized elements at a high temperature. Now that it had cooled to the temperature of the earth it was in a position to de-energize itself. This energy was dissipated in the form of streams of electrons and alpha rays, the latter being gistotopic helium and traveling at a rate of 20,000 miles per second. It would be the problem of the future to harness this enormous energy and put it to economic use in the form of heat, light and electricity.

Although no immediate relief to the power situation can be expected, it is good to know that a time may come when radium energy will come under our control and allow itself to be harnessed.



KEEP GOING!

"Motor World."



MARKET DEVELOPMENTS



The Steel Market Holds Interest This Week

Several Local Steel Men Left at the Week-End for Steel Centres of United States to Find Out Just How Matters Stand—Reports From Several Centres.

DEVELOPMENTS in the steel market are the outstanding feature of the week in machine, iron and steel circles. Some of those who watch the market closely believe there are symptons of a runaway market if those at the head of affairs do not hold the thing in check. The first answer of the corporation to the independents was the announcement—hardly made officially yet—that Canadian business would now be regarded as domestic trade by the United States rollers. For some time past Canadian orders have been regarded as export trade, and carried a higher price as a result. It means that there will have to be considerable readjustment in order to protect the business already on the books of the corporation, and some of it has been waiting there for a year now. Where a definite price has been given on a contract it is not considered necessary to make allowance, but where material is bought for warehousing, or where the sale of the product depends on current quotations, there will probably be a transfer of the business from the old figure to the new. At least that is the expectation in the Canadian market.

There are a number of inquiries in the market for machine tools and kindred equipment, but the trouble lies in the fact that much of it cannot be closed. In some cases it is hard for firms to finance the purchase now, as they are anxious to keep all available cash for working capital. On the other hand there is a marked tendency on the part of many buyers to rather glory in the fact that this is a buyer's market, and the firm that wants the business must come along and bid lustily for it.

The scrap metal market remains just where it was last week, in the dumps. Dealers will not guarantee to pay the prices they authorize, and there is almost nothing going on. Buyers are out of the market, and dealers are also in many lines. Prices are still downward, but no dealer seems to have the heart to batter down the present lowly list. The figures, though, are only nominal.

SUSPENSION IS ONLY TEMPORARY PROSPECTS BRIGHT FOR NEW YEAR

Special to CANADIAN MACHINERY.

MONTREAL, Que., Dec. 2.—The keener competition that features the trading in all lines of commodities foretells a further adjustment in selling prices. Mills are realizing that they must take a share of the losses incidental to a declining market, and the present policy seems to favor a disposal of surplus stocks before heavy production can be considered on the changing basis. There is, however, an effort of conservatism in taking the downward steps to avoid a fall that might have serious after effects, should the dormant demand, now supposed to exist, suddenly develop to an active reality.

Despite the fact that present demand is below normal, the feeling still exists that industrial and manufacturing requirements are only held in temporary suspension and that early in the year may see a return to a more healthy condition in respect to future bookings. Speaking of the relative cost of production, one dealer said: "It should be borne in mind that during the war exports of all steel and metals from the States were excessive, and that production was carried on in an extensive manner. For many months after the war this same condition obtained, but during the past year the rehabilitation of European countries resulted in re-establishing steel activities in Europe, and consequently the necessity of importing fell off, so that mills here and in the States had to look to their home requirements to absorb the output from the mills.

"This condition became more pronounced with the general falling off of trade so that curtailment in manufacturing was the logical outcome. Owing to many circumstances this lessening of activity meant a proportionate increase cost per ton in the making of the steel, as in many instances the overhead costs remained the same on the smaller tonnage output. The adjustment now going on is the first real move in this direction since the war ended, and as we must have it, the sooner the better." The steel demand in this district is rather quiet and will likely remain so during the month of December. Dealers, however, are not discouraged as reports and inquiries are of a character to indicate that placement of good business is only awaiting a more settled condition of trade.

The plate situation has developed no new features of interest other than a lighter demand. Shipyards are not so busy and material coming in for this purpose shows a marked falling off. The sheet situation is easier and the supplies are more readily obtained; this applies more particularly to black sheets as the call for galvanized is still good. Queen head and fleur-de-lis are down 50 cents per hundred, the respective quotations being $13 and $12.50 per hundred.

Further Declines in Metals

The further reductions that have been made in the price of ingot metals indicates the effort that is being carried out in the universal adjustment to a more reasonable working basis. This is not literally true, as production costs today are in excess of what they should be in comparison to what metals are selling for on the current market. What is actually taking place is the liquidation of accumulated stocks, and this will probably require some time, especially as consumption just now is below normal.

The demands from Europe since the war have rapidly declined and no corresponding outlet has been found for American metals, the consequence being that refiners here have had to adjust their output to existing needs, which, at present, is in excess of trade requirements, and in face of the high production costs the stocking of metals has no inducements for the refiners. Ingot metals are marked down from ½ cent to 1 cent per pound. In copper products, bars are quoted at $35; plain sheets at $40; copper sheets, tinned, at $43, and planished copper sheets at $47. Lead sheets are also easier, the price ranging from $10 to $10.50 per hundred pounds. Brass rods, sheets and tubing are likewise lower, the quotations being 30, 38 and 42 cents respectively. Copper tubing, seamless, is now 44 cents per pound.

No Market in Scrap

"The prices you are quoting," said a dealer in old materials, "are just as good as any other, as trading at present is not influenced by the price. We offered 13 cents just this week for a quantity of copper wire, but the sale was not made, and we are just as well pleased. It would have meant carrying it in stock, and this we are not anxious to do." The listless character of the old material market is not conducive to enthusiasm on the part of dealers, and the apparent disinterest reflects the trade depression. Some little movement is always in evidence but the volume is very light.

Dealers look for a quiet period for the remainder of the year, and do not anticipate excessive activity for some months, although many are hopeful of a gradual betterment after the holiday season. Prices quoted might be shaded a little, but lacking an actual sale, the list may be considered as that generally prevailing throughout this district.

NEW STEEL PRICES SOON EFFECTVE

Trade in Canada Should Get Advantage of These in a Short Time

TORONTO.—The new prices that are coming to the steel market formed the chief topic of conversation this week. In fact so interesting was this matter that the week-end saw several of the local steel merchants hurrying off to New York and other steel centres to see just where they stood, and what the chances were for stability, many of them seeming to think that there were present all the makings of a runaway steel market which might develop before many days were over.

The machine tool market is quiet. At this season of the year there is generally a period when little business is in the market, but the facts are that right now it is more than seasonably dull, although there are a number of very good inquiries in the market. The feeling is growing that a frank statement on the part of the machine tool builders in regard to selling prices and policies would do something to clear the air, and allow the work of placing business to proceed. Right now the price change is a sort of checkerboard affair, as some of the makers have announced reductions, while others have not, and their agents in this part of the country seem to be quite satisfied that they will not name any lower selling costs.

There is generally a desire on the part of firms to make as much of a clearing-out at this time of year as possible, in order to keep up the total figures for the year, especially if their fiscal year ends with the calendar year, and this is the practice with the majority of the firms. No doubt there is some of this being done, but not to the extent that might be imagined. For instance, one report tells of the sale of a new radial drill, never taken out of the crate, that went out at almost half the regular price. Other sales of this sort are also heard of, but after all they are only incidents in the market, and do not indicate at all that the general policy of selling is moving in this direction.

Price or Uncertainty?

"We have a number of very attractive inquiries, but we can't sew up the business," was the remark of two different offices this morning.

"Why? In some cases they find it a little hard to finance the business, wanting to hold on to all the available cash they can. We are looking for something a little easier in this line before very long.

"Then again there are buyers who seem bound to ride around on the strength of the fact that this is more of a buyer's market than it has been for some time past. It is not an unusual proposition now for a man to have the specifications for a machine up his sleeve, and go around as though saying, 'Here's what I want, and the man who can come across with the most attractive looking proposition is going to get the business."

Then, again, there are reports of where firms and salesmen cannot come to an agreement regarding the price. There is one case where a nice order is waiting for a certain line of equipment, but there is a strong difference of opinion over the figure, and so far it nas not been settled.

The Steel Market

A stock list coming to one of the local steel warehouses this morning conveyed the information that one of the independents offered sheets at 5.25 for immediate shipment. Formerly, when prices looked as though they would have to come down, the independents reduced business on their books from 8c to 6.25, largely with the idea of protecting it, but that is as far as they had come previously, while the new price

POINTS IN WEEK'S MARKETING NOTES

Cleveland does not deny that there is a slump, but feels sure it will be on the mend by the New Year, and normal by April.

—

Tendency in the machine tool business will be to cater to a diversified custom in future instead of specializing on one line.

—

Steel Corporation prices now are the ruling factor in the markets, most of the independent mills having adopted them.

—

The price of sheets has declined, but the lower rates have not had the effect of stimulating buyers.

—

Bessemer and basic are still declining but the decline is not so rapid as has been the case lately.

—

The local machine tool market has quite a few good enquiries out, but business is rather uncertain.

—

One independent mill is offering the Canadian trade black sheets at 5.25 base, this being the lowest figure given here yet. It cuts under the rate that has heretofore been given by the Steel Corporation.

—

U.S. reports indicate that if the new steel market revives buying of steel, there will be better business in sight for machine tool trade.

—

Pittsburgh claims that the new prices on steel are not bringing in any new business. Buyers look for more cuts and are waiting.

—

The local scrap market will answer to almost any reference that is made to it, provided it is uncomplimentary and indicative of stagnation and inaction.

—

Dealers having lines that are sold to farmers report a very active trade. For instance, engines are selling rapidly.

—

Firms that are having the hardest time now are those that specialized almost entirely in making parts for automobiles. They narrowed their field in that way to such an extent that when the auto business fell off they were almost done for.

—

Prices published this week may be changed on short notice, so allowance should be made for that.

they are quoting means that they are under the Steel Corporation price as it has been quoted here. The Corporation price to Canadian users has been all along 5.35.

The United States Steel Corporation is now prepared to regard Canadian business as domestic rather than as export business. This statement held good from the first of the week on bars and structural material and a similar statement is likely to come out at any moment governing the selling of sheets and other lines. This is a concession that has been looked for for some time back, and one which the trade in this country formerly enjoyed.

"How will existing business be attended to in view of the cut that has been made?" Canadian Machinery put that question to the Canadian manager of the U. S. Steel Products. It is something that the trade looks for at once when a new price is announced. This is the plan, as we understand it:

When a customer has figured on a definite contract, and has placed his order for the steel at a figure that will allow him his legitimate profit, he is not entitled to a reduction to meet the new market, for there is no necessity of him doing so in case the contract is still standing. On the other hand, if a firm or a warehousing concern has placed an order that they will have to resell, they will be protected on the new price. There may be a few variations from that programme, but as we understand it, that plan is substantially correct.

Some of those who are in the market all the time profess to believe that there is the makings of a real runaway market in existence if a certain amount of care is not exercised. Some dealers believe that the Corporation will now find it necessary to protect their own bookings.

The Scrap Market

Nothing is changed in the scrap metal situation, and it remains in about as dead a condition as could be imagined. Dealers will not state whether or not they will pay even the rather lowly price list which we publish in another column. Although the figures were furnished by the dealers themselves, they will not guarantee for the present to pay them unless they have some place where they can place the material.

NARROWED THE FIELD BY NOT CATERING TO DIVERSIFIED TRADE

Special to CANADIAN MACHINERY.

CLEVELAND, December 2.—The firms or cities that have been taken up largely with supplying machinery, material or parts to the automobile trade have learned that it is not wise to put all the eggs in one basket. The dependence on one line has meant the neglect of developing others that might have been good to them now. They find that through trying to reach a very high efficiency in this line they have narrowed their field.

The best thinkers around this district, men who are heavily interested in the machine tool, iron, steel and metal industries, make no bones about the matter. They say they are caught in a slump and that it is a real slump, but in the next breath they tell you that it came quick and hard, and is going to move away rapidly. If one were to make a summary of all these opinions, a conservative answer would be that the start back will be around the first of the year, and that by April the new movement will be well under way.

These firms that were so geared up that they sank or swam with the automobile trade are quietly saying "never again," and are now preparing to cater to a much more diversified field. Erie, they tell us, is the third city in the world in the diversity of her manufactures, and the tone of business there right now is absolutely the best to be found in this whole district.

Pittsburgh can best be described as waiting.

One War-Time Lesson

Firms that are in good shape are going carefully in order to keep their credit sweet. They are curtailing expenses and making more investigations before placing advertising contracts. And right here is a peculiar development. A short time back advertising was looked upon by some of the firms as a good place to dump some of their surplus in order to keep it from the Government. New equipment was often put in on the same basis. But this advertising done by many firms on this rather loose basis has been the means of convincing the firms that advertising is a real, positive force, and these newer firms are looking upon it as a real factor in their business development. They now look upon advertising as an investment and not as a place to hide profits. There is a stated appropriation now in firms that just used to "spend money."

Travellers are working their territory harder. They have instructions not to make long jumps. Sales managers in some cases have taken over the work of the advertising department.

Some sales managers are working half crews all the time, and others, in order to hold their organization, work crews half time. This latter seems the more favored idea, but it cannot always be done because they must work them long enough to give the men enough in their week's wages to live on.

The Matter of Wages

Labor is shifting in many cases. Machinists are working in several plants for 65 and 75 cents per hour where $1 was the rule before. For the present at least that fine old idea of "not liking your job" has ceased to be. It's a case of "have you got one?" The best men are being retained, and figures show that these men are working harder so there is a consequent improvement in production.

Another market being watched closely is steel, and it is mostly a waiting game to see when it is going to hit bottom.

This is Interesting

Speaking of association gatherings, one of the large builders of tools tells me that they all go to the annual convention—just finished a week or so ago in New York. Well, when they are there it's a case of scratching each others' backs and making statements about there being no cut in their prices. Then on the way back from New York many of them get out their lists and put the axe into them.

But after all—and this is from a visit to a number of centres, Cleveland, Pittsburgh, Erie, Canton, etc., there is a feeling of splendid optimism. Business has been running mad in some directions, and there is a determination to get down to a more secure foundation, and once that is done it will be a case of full speed ahead.

CHANGE FROM OIL TO COAL BURNER

Scarcity of Fuel Oil Makes it Necessary For C. P. R. to Alter Equipment

Vancouver. — The Canadian Pacific Railroad Company, on account of the acute oil shortage, is changing all its equipment, including steamships, to coal-burners.

It is estimated that the change will cost close to $60,000 for each steamer and $12,000 for each locomotive. The first coal-burning engine used by the road in the last five years left the station here last night with a transcontinental train.

H. W. Brodie, general agent of the company in the West, said that the oil shortage was due to the fact that the Standard and Union Oil Companies could no longer afford to supply the road with 70,000 barrels daily. He had heard, he also said, that the United States Navy Department was about to take over the Union Oil Company for its own use, and that the Standard was too busy supplying fuel for automobiles and transportation in the United States to provide for Canada.

ALL ON CORPORATION PRICES— BUT WILL THAT SCHEDULE LAST?

Special to CANADIAN MACHINERY.

PITTSBURGH, December 2. — Late last week the remaining independent steel makers came down to the Steel Corporation prices on bars, shapes and plates. More than a month ago an independent at St. Louis quoted the corporation price on plates. Later a Chicago independent came down on bars and over a week ago some Cleveland mills were quoting the corporation prices. However, on Wednesday of last week a canvass showed that five or six large independents were quoting 3.00c on all three products, the corporation prices being 2.35c for bars, 2.45c for shapes and 2.65c for plates. Thursday was a holiday and Friday morning an independent in Youngstown and an independent in Pittsburgh began quoting the Steel Corporation prices, the others immediately following, as it requires only a few hours for information of this sort to get around the trade. The established custom in the trade is that when a buyer is quoted a cut price by a certain mill he does not place an order at the cut price, but immediately tells all the other mills about it.

The reductions represented a case of the mills practically running out of orders at higher prices. The larger mills were not expected to run out nearly so soon. A couple of months ago several were claiming to be filled with business at least to January 1, if not longer, but it seems enough tonnage was cancelled to make a difference of several weeks. There is some tonnage left on books, but not a great deal. In general, the remaining tonnage will be adjusted in price to meet the new market.

Return to Industrial Board

The Industrial Board prices, representing the second reduction in steel prices from the war control schedule, became effective March 21, 1919. The Steel Corporation has consistently adhered to those prices. The first thing the independents did was to cut the prices, practically all the independents selling at cut prices during April and May, 1919. Afterwards, as they filled up, they began to look to the Steel Corporation to advance prices. This the corporation would not do. Late last year, or about a year ago, the independents began advancing prices on their own account, and at the beginning of this year practically all the independents were at advanced prices, a notable exception being the tin plate mills. When the time came to make contracts for the second half of this year the independents demanded higher prices on most of the business, but not on all. Within the past two or three weeks the independents returned to the Steel Corporation price on tin plate. Now the action is followed by the independents on bars, shapes and plates. The remaining important products are sheets, pipe and wire. On these the independents are still above the corporation. The reason the independents are still above the corporation on these products is that they still have a considerable tonnage of business on books, but of late this has been greatly diminished by cancellations, and it may not be long until these products fall in line.

Sheets Decline

Sheets were so extremely high in the independent market that they could decline a long time before getting to the Steel Corporation or Industrial Board level. For a couple of months or more the black sheet market declined at the rate of about a quarter cent a pound per week, but in the past fortnight there has been a decline of one cent. One can readily buy now from several independents at 5.00c for 28 gauge and on an attractive order even this price would probably be shaded $2 or $3 a ton. Galvanized sheets can be had at 6.50c. At the beginning of last week one mill was quoting 6.70c. others being at 7.00c or higher, but at the close of the week there were several sellers at 6.50c. In blue annealed the common quotation is 4.50c, but this basis could probably be shaded a trifle on the lighter gauges, while it could be shaded considerably on the heavier gauges, those that can be produced by light plate mills.

No Buying

Reduced prices have not brought the independents any additional business, nor was it expected that business would be created by this means. Buyers are bent upon having the smallest possible inventories and commitments January 1. The business of jobbers and manufacturing consumers has slowed down very greatly and naturally the buyers will not purchase from the mills except as they have occasion to sell or consume the material.

Manufactured Products

The market for cold finished steel bars of late has been 4.00c, with some producers still quoting 4.25c. The market was 3.60c when the makers of cold finished steel bars were getting their bars at 2.35c, but prices were advanced afterwards even by makers who were getting their bars from the Steel Corporation. The question now is whether the makers will reduce their prices at once below 4.00c. Thus far they show no inclination to do so. Standard railroad spikes remain at 4.00c, but this price is too high by comparison with bars at 2.35c. Before the war, when costs and profits were less, the spike makers used to consider a spread of $9 a net ton between bars and spikes as a fair one.

Mill Operations

Independents as a whole are probably operating at an average rate of less than 50 per cent., while the Steel Corporation continues to operate as well as at any time in recent months, being very well supplied with business. A few independent mills are closed entirely, but such closings are not permanent, being for the purpose of accumulating specifications. For some time to come, and until demand develops, independents are likely to close for two or three weeks at a time and then run for a week or two at a fair rate, this being much more economical than to maintain a low rate of output continuously. The Steel Corporation is likely to run for months at nearly if not quite its usual rate.

Pig Iron

Bessemer and basic are down $2.50 in the week and foundry $2, the market being now quotable at $37 for foundry, $37.50 for Bessemer and $35 for basic, f. o. b. valley furnaces, freight to Pittsburgh being $1.96. The declines in Bessemer and basic occurred by way of there being offerings rather than quotations against actual inquiries. In foundry there were one or two small sales to bring out the lower quotation. The bottom, of course, is not yet reached, but as declines of $13 in foundry, $11 in Bessemer and $13.50 in basic have occurred from the top points reached last August it is expected that further declines will be at a slower rate. Furnaces admit that prices will decline to cost, but there is a question where the cost line lies. No close figuring can be done as long as the coke market has not settled. For the past fortnight the Connellsville coke operators have maintained spot furnace coke at $8 to $8.50 and furnaces consider such prices ridiculous, being in doubt whether they would pay even $6.

Semi-finished Steel

The first sale of any semi-finished steel at the Steel Corporation price occurred a few days ago, a sheet mill in the Pittsburgh district buying 2,000 tons a month of sheet bars for December, January and February at $47 Pittsburgh, or $48.40 delivered. The identity of the seller is not disclosed and the independents do not yet admit a willingness to sell at the Steel Corporation prices.

According to tests carried out by the United States Forests Products Laboratory on fences of charred and untreated posts of various species, charring is of little value in protecting the butts of fence posts and telephone poles from decay. The charred posts proved in these tests to be even less durable than the untreated ones.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$39 96
Lake Superior, charcoal, Chicago	53 50
Standard low phos., Philadelphia	44 79
Bessemer, Pittsburgh	41 96
Basic, Valley furnace	37 50
Toronto price:—	
Silicon, 2.25% to 2.75%	57 50
No. 2 Foundry, 1.75 to 2.25%	56 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 75
Steel bars, base, Montreal	5 75
Reinforcing bars, base	5 50
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	8 50
Chequered floor plate, ¼ in.	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	3 50
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	5 50
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 67 to 5 50
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58½	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

METALS

	Gross. Montreal	Toronto
Lake copper	$19 50	$20 50
Electric copper	19 00	20 50
Castings, copper	18 25	20 50
Tin	45 00	50 00
Spelter	8 75	10 00
Lead	7 75	9 00
Antimony	8 25	9 00
Aluminum	35 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 6 50	$ 7 00
Plates, ¼ up	6 00	6 60

PIPE—WROUGHT

Standard Buttweld Pipe

Per 100 Ft.

	Steel Blk.	Steel Galv.	Gen. Wrought Iron Blk.	Gen. Wrought Iron Galv.
⅛	$ 6 50	$ 8 50	$.....	$.....
¼	5 31	7 41	5 91	8 01
⅜	5 31	7 41	6 91	8 01
½	7 10	8 63	7 95	9 48
¾	8 80	10 87	9 95	12 02
1	13 01	16 07	14 71	17 77
1¼	17 60	21 74	19 90	24 04
1½	21 04	25 99	23 79	28 74
2	28 31	34 97	32 01	38 67
2½	44 75	55 28	....	....
3	58 52	72 29	....	....
3½	74 06	90 62	....	....
4	87 75	107 37	....	....

Standard Lapweld Pipe

Per 100 Ft.

	Steel Blk.	Steel Galv.	Gen. Wrought Iron Blk.	Gen. Wrought Iron Galv.
2	$32 01	$ 38 67	$35 71	$42 37
2½	48 26	58 79	54 11	64 64
3	63 11	76 88	70 76	84 53
3½	75 90	92 46	85 10	101 66
4	89 93	107 55	100 83	120 45
4½	1 05	1 29	1 30	1 54
5	1 22	1 50	1 52	1 80
6	1 58	1 95	1 97	2 33
7	2 06	2 53	2 53	3 01
8L	2 16	2 66	2 66	3 16
8	2 49	3 07	3 07	3 64
9	2 98	3 67	3 67	4 36
10L	2 77	3 41	3 41	4 05
10	3 56	4 39	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.

4½" and larger, 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%.

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$10 50	$10 50
Copper, crucible	13 00	12 00
Copper, heavy	12 50	12 00
Copper wire	12 50	12 00
No. 1 machine composition	13 00	12 00
New brass cuttings	7 00	9 00
Red brass turnings	10 00	10 00
Yellow brass turnings	7 00	7 50
Light brass	5 00	5 00
Medium brass	6 50	6 00
Scrap zinc	5 00	5 50
Heavy lead	5 25	5 60
Tea lead	2 50	3 00
Aluminum	16 00	16 00

	Per Ton	Gross
Boiler plate	13 00	12 00
Malleable scrap	20 00	23 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	23 00	25 00
No. 1 machine cast iron	32 00	33 00
Pipe, wrought	9 00	10 00
Car wheel	30 00	33 00
Steel axles	20 00	20 00
Mach. shop turnings	8 00	9 00
Stove plate	25 00	25 00
Cast boring	8 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	+10
Carriage bolts, ⅜-in. and less	Net
Coach and lag screws	—15
Stove bolts	55
Wrought washers	—25
Elevator bolts	+10
Machine bolts, 7-16 and over	+10
Machine bolts, ⅜-in. and less	+10
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 50
Nuts, hex., tapped	add 3 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent.
Set screws —20% 25 and	5
Sq. and hex. hd. cap screws	12½
Rd. and fil. hd. cap screws	plus 25
Flat but. hd. cap screws	plus 50
Fin. and semi-fin. nuts up to 1-in.	12½
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	—5
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	+12½
Studs	+5
Taper pins	—12½
Coupling bolts	+40
Planer head bolts, without fillet, list	+45
Planer head bolts, with fillet, list plus 10 and	+55
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	+60
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add +85
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails, base	$6 10
Cut nails, base	7 00
Miscellaneous wire nails	50%

ROPE AND PACKINGS

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

LeBLOND
HEAVY DUTY
Universal Millers

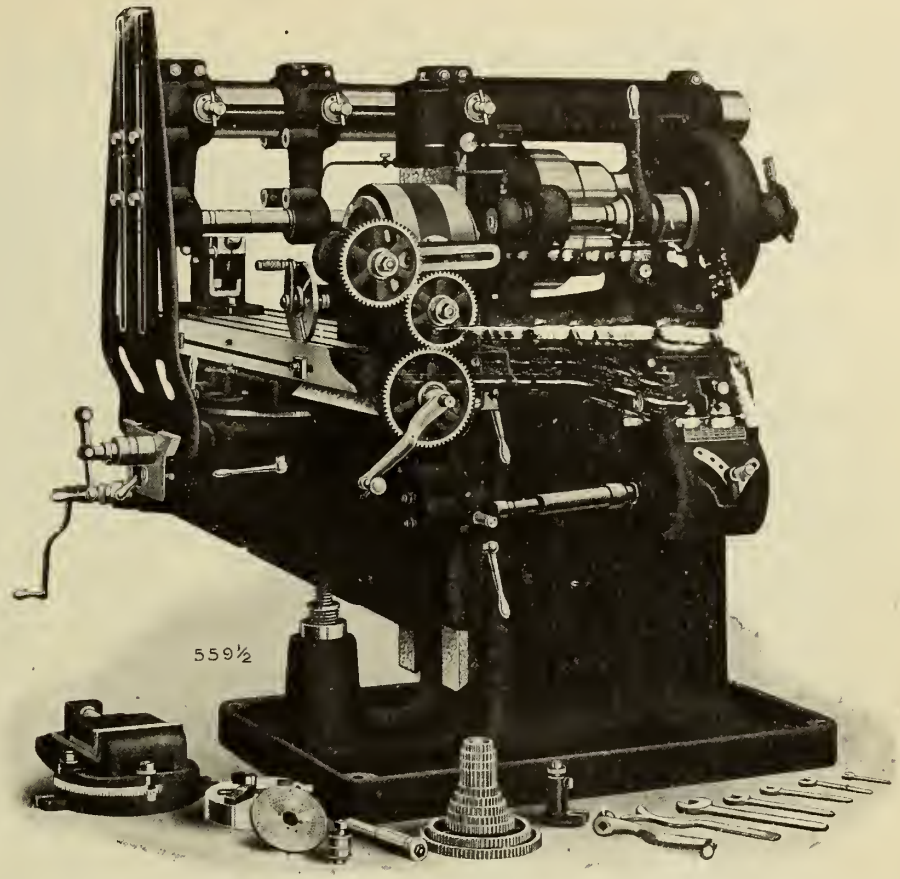
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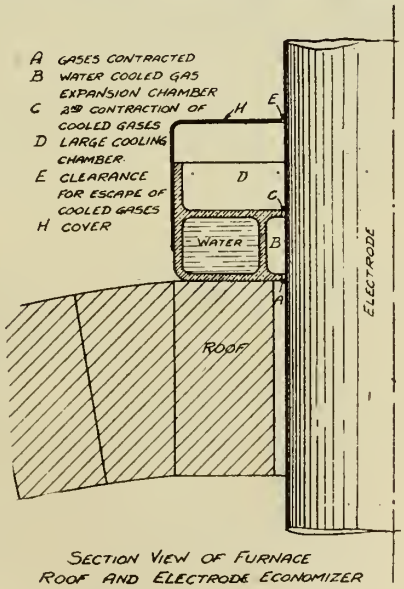
HEAT LOSSES IN OPERATION OF ELECTRIC FURNACES

(Continued from page 498)

ling of electrodes and other troubles caused thereby. These economizers have been fitted to a number of furnaces and have stood up remarkably well. Some have been in constant operation for six months and are as good now as the day installed. The invention is covered by patents, but can be supplied for all types of furnace. A full description of the device was presented at the recent meeting of the Association of Iron and Steel Electrical Engineers, by Mr. E. T. Moore, chairman of the electric furnace committee, but a brief description will probably interest.

The Brooke economizer depends for its action on the well known scientific fact that hot gases under pressure, if suddenly allowed to expand, quickly lose their high temperature. The gases generated in an electric furnace are only combustible at high temperatures and in the presence of oxygen. All other cooling rings simply content themselves with cooling these burning gases. In the Brooke economizer the gases never do ignite, the roof ports and the electrode are kept reasonably cool and the gases leaving the furnace are at too low a temperature to ignite.

The gases pass first of all in between the electrode and the port hole roof and



SECTION VIEW OF FURNACE ROOF AND ELECTRODE ECONOMIZER

FIG. 2—DETAIL OF COSTRUCTION.

then through the small clearance marked A, Fig. 2, into the cooling ring and into a relatively larger chamber B, whcih causes the expansion of the gases and thereby giving up a large amount of sensible heat in the gases. This heat is absorbed by the water in the cooling ring. From chamber B they are once more contracted through the small clearance C and then passed to a very large chamber D for a second and chief expansion. The design differs slightly with amorphous or graphite electrodes, but the effect is that no flame is seen from the top of the furnace and the electrodes do not pencil off.

The attached photograph, Fig. 1, shows a 3-ton Greaves-Etchells furnace at the Dodge Steel Co., Tacony, Pa., and illustrates the actual size of the cooling ring. It will be noticed that although the electrodes are withdrawn and the furnace is pouring there is no flame or reduction of diameter. Even when carbon is thrown on the slag no flame appears. On a recently installed four-electrode furnace the monthly figures were 12 pounds of graphite electrodes per ton. The average over six months was 12½ pounds, with a power consumption of 550 kw. hours per ton of steel.

Tests are now being made on a furnace fitted with the special type cooling ring, but it can be seen with the naked eye that the temperature of electrodes is far less, and therefore considerable saving of heat and power does take place.

The Labor Temple, Vancouver, B.C., is to be remodelled for a technical school.

Excavation has commenced on the site of the new Gendron factory, north of Danforth Avenue, Toronto. It is expected that the factory will be completed about the end of February and will employ about 500 men at the start.

MISCELLANEOUS

Solder, strictly	$ 0 28½
Solder, guaranteed	0 30½
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	20 35
Red dry lead, 100-lb. kegs, per cwt.	15 00
Gasoline, per gal., bulk	0 42
Pure turp., single bbls., gal.	3 15
Linseed oil, raw, single bbls.	2 37
Linseed oil, boiled, single bbls.	2 40
Wood alcohol, per gal.	4 00
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S.S. drills, wire size	35
Can. carbon cutters, plus	10
Standard drills, all sizes	35
3-fluted drills, plus	10
Jobbers' and letter sizes	35
Bit stock	40
Ratchet drills	10
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers, carbon	50
Centre reamers	5
Chucking reamers	net
Hand reamers	10
High speed drills, list net to plus	20
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares ..... $7 base
Hexagons and flats ..... $7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	70	85
Class B	30	40
Class C	20	30

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 9 25	$ 9 50
Sheets, blue ann., No. 10	7 75	8 50
Canada plates, dull, 52 sheets	13 00	13 00
Can. plates, all bright	14 00	.....
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	13 00	.....
Fleur-de-Lis, 28 B.W.G.	12 50	.....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	12 00
Premier, 10¾-oz.	11 50	12 40
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	35 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	29½
Palacine	32½
Machine oil, per gal.	65
Black oil, per gal.	34
Cylinder oil, Capital	1.01
Petroleum fuel oil, bbls., net	19

BELTING—No 1 OAK TANNED

Extra heavy, single and double	6½
Standard	6½
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 30
Brass sheets, 24 gauge and heavier, base	0 38
Brass tubing, seamless	0 42
Copper tubing, seamless	0 44

WASTE

XXX Extra	.24	Atlas	.20
Peerless	.22½	X Empire	.19½
Grand	.22½	Ideal	.19
Superior	.22½	X Press	.17½
X L C R	.21		

Colored

Lion	.17	Popular	.13
Standard	.15	Keen	.11
No. 1	.15		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.20	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$35 00	$37 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	40 00	44 00
Copper sheet, tinned, 14x60. 14 oz.	43 00	46 00
Copper sheet, planished, 16 oz. base	47 00	50 00
Braziers', in sheets, 6 x 4 base	39 00	42 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 50	$14 50
Sheets, 3½ lbs. sq. ft.	10 25	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 00	13 50

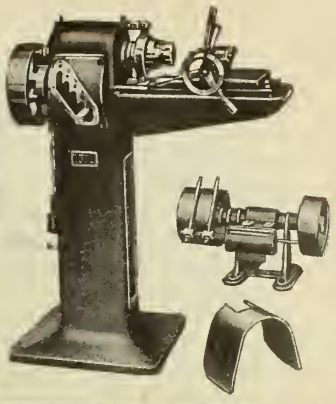
Cut sheets, ½c per lb. extra
Cut sheets to size, 1c per lb. extra

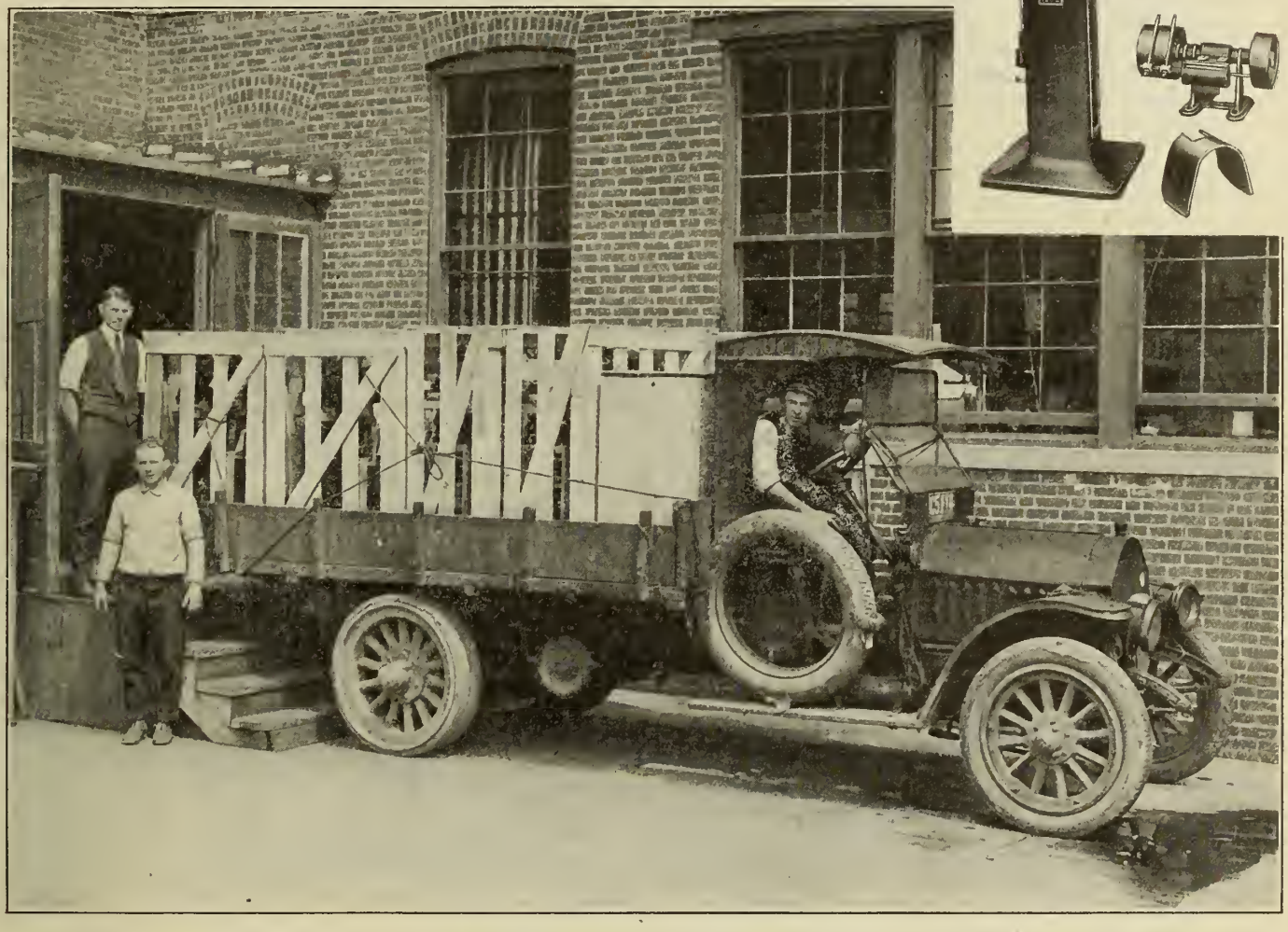
PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.04¾
Acid, nitric	.11
Acid, sulphuric	.04½
Ammonia, aqua	.15¾
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.16
Copper, carbonate, annhy	.41
Copper, sulphate	.13
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.20
Nickel carbonate	.32
Nickel sulphate	.20
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lbs	9.00
Sodium phosphate	.15
Tin chloride	.30
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated

A SIGN OF INCREASED PRODUCTION





Every Shipment of Geometric Threading Machines Means Increased Production and Decreased Costs in the Shops Where They Are Consigned.

Small threaded parts are correctly duplicated in shortest possible time. These machines thread work which cannot be handled on the ordinary Screw Machine or produced economically in any other manner.

There are three sizes—½-inch, ¾-inch and 1½-inch. The threaded diameters range from ⅛-inch to 1½-inch inclusive.

Make Screw Thread Cutting the most satisfactory operation in your plant.

THE GEOMETRIC TOOL COMPANY
NEW HAVEN CONNECTICUT

Canadian Agents :

Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg, St. John, N.B., Halifax, N.S.
Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

If interested tear out this page and place with letters to be answered.

NEW YORK LOOKS FOR MOVE TO BETTER BUYING NEXT YEAR

Special to CANADIAN MACHINERY.

NEW YORK, Dec. 2.—The development of the past week of outstanding importance is the announcement by leading independent manufacturers of steel products that they have reduced their prices on plates, shapes and bars and some other products to those which have been in effect since March 21, 1919, on all orders taken by the United States Steel Corporation. While the major products have come down, certain other products such as rails, wire and nails, sheets, etc., are still higher, as quoted by independent mills, than the prices quoted by Steel Corporation subsidiaries.

The reduction in steel prices has a direct relation to machine-tool trade, as any revival of business in iron and steel lines must of necessity be preceded by an adjustment of prices on steel that will bring buyers back into the market with a greater degree of confidence that the bottom had been about reached.

The machine-tool trade sees ample evidences of a willingness on the part of manufacturers to buy shop equipment, but the general uncertainty has caused them to hold aloof. Even actual and pressing needs for machine tools have been put off until after January 1 in numerous instances. The readjustment of steel prices by independent mills is an important step toward the expected revival of business next year. If the railroads, for example, buy steel in fairly large quantities they will surely buy machine tools, as many of their shops are greatly in need of complete rehabilitation. Several large railroad lists have been held up by Eastern roads until after January 1, but there is a strong expectation that they will be issued early in the new year.

Current business in machine tools is very light. Some machine-tool builders are not booking enough business to pay expenses. Dealers have not done more than 10 to 15 per cent. of a normal business during November. There is no expectation of any buying in December, but the turn of the year is being looked for with interest and a greater feeling of optimism than has prevailed in many weeks.

GOODS WILL MOVE IF PRICE IS RIGHT WAR PRICES AND WAR PROFITS ARE PAST

THE final chapters in the industrial liquidation are now being written. The retailers are at last falling into line, and where they have shown a disposition to meet their customers' views as to prices, they have demonstrated that there is an enormous latent purchasing power. There is no doubt of the ability to move goods into the hands of final consumers, provided the price is right. It should not take long to clean up present stocks once the retailers, generally, adopt the policy that the leaders have already started. Then will follow the replacement of stocks which, thanks to heavy reductions in price by manufacturers, can be done to good advantage. Of course, all this means that war prices and war profits have gone for good. All must disabuse themselves of the idea that these can be retained at any stage. But the point is, first, that there is now promise that the period of industrial recession will be comparatively short-lived and secondly, that even what used to be considered normal profits would, in the large majority of cases, amply support present stock prices. In this way Hayden, Stone & Co. review the market situation in their weekly letter.

Even the most stubborn of the obstacles to a return to healthy active conditions is beginning to give way, they continue. We allude to the question of wages. During the war period, these were largely paid out of capital. Of course, this could not long continue without complete disaster. Henceforth, they will be paid according to the ability of industries to meet them. It will be, in the end, more satisfactory to be assured of a certain wage, even if less in dollars and cents, that will have a purchasing power equal to a normally higher but actually far more uncertain remuneration.

There is, however, one rather disturbing thought; our prosperity in the last five years has been largely based on Europe's demand for our goods, at abnormal prices. This demand will, henceforth, not only be radically diminished, but will be replaced by the ability of Europe to compete in our own markets. Even after severe markdowns, our prices will be very attractive to European producers, especially on present exchange rates. Europe still owes us enormous debts. These cannot be paid in money; they must be met with goods. Whether it is better to let these goods in at such prices as to jeopardize our own manufacturers, or to protect them against this influx, even if to do so it may be necessary to forego payment of this debt, is a deep economic problem, which it is hardly the function of this letter to take up, but the mere fact that such a problem exists emphasizes that world competition is being rapidly restored and that some outlet must be found for our own goods, as our productive capacity is probably well in excess of our own needs. We mention this to bring out the fact that while it is to be hoped that industry will, in the course of a few months, be again fairly active, the element of competition will be very prominent and the margin of profit correspondingly small.

HAVE NO MORE ORDERS ON HAND

Director of Vickers Ltd., Says Not Much Future for Shipbuilding

Montreal.—The "Canadian Leader," 3,340 net tonnage, the twelfth ship built for the Canadian Government Merchant Marine, and the sixth this season, by the Canadian Vickers Ltd., was successfully launched from the yards of the company.

At the subsequent reception A. R. Gilham, managing director of Vickers Ltd., stated that his firm had launched more than 50,000 tons of shipping during the current year.

He painted a gloomy picture of the conditions that now confronted his company and the Canadian shipbuilding industry in general. More than 40 per cent. of Canadian shipyards had sung their swan song, he said, and, unless Government aid were forthcoming the same fate confronted the Vickers company. "The sorry fact is," said Mr. Gillham, "that we have no orders for next year. We have two boats now on the stocks which we hope to launch next April, and if there are no further orders by that time the yards will be forced to close."

KEEP AS MANY ON AS POSSIBLE

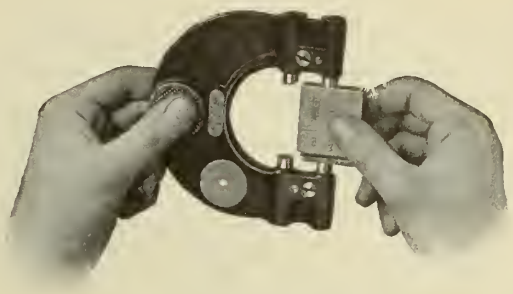
C.M.A. at Conference Discuss Ways of Dealing With the Present Situation

At a joint meeting of the Ontario Division executive and Toronto branch executive of the C.M.A., very full consideration was given to the problem of unemployment throughout the Province of Ontario. The executive viewed with apprehension the present condition of unemployment generally, but they had in mind that there is always a certain amount of unemployment at this season of the year, which is accentuated by the fact that a number of unemployed, who do not belong to this city, locate in Toronto in search of work, thus aggravating the local labor situation.

The executive strongly recommended to all manufacturers to do everything possible to prevent the laying off of too many men where it is at all avoidable, and it was agreed when a reduction of working time is necessary to carry out the reduction by closing for whole days rather than for parts of days, so as to minimize factory disorganization and inconvenience to the workers and thereby keep as many men employed as possible.

Aikenhead's

AIKENHEAD'S large stocks enable them to supply "Everything in Tools." They are prepared at all times to fill your requirements promptly—be they large or small. This, and efficient, courteous service has made Aikenhead's, **Canada's Leading Tool Supply House.** Give them a trial.



Johansson

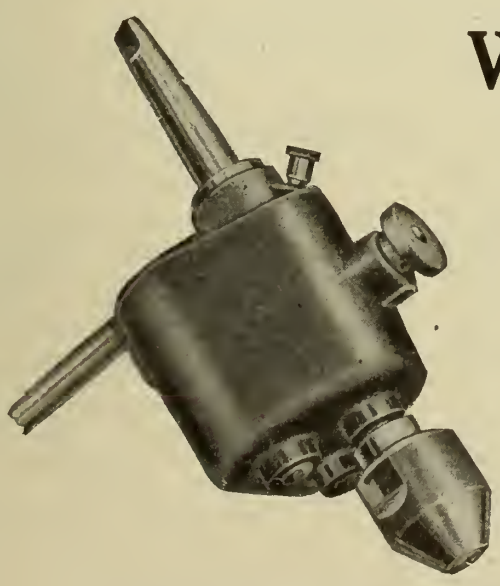
The World's Standard of Precision Gauging

EVERY machine shop, inspection department, and manufacturing plant must agree and know, beyond possibility of dispute, just precisely what constitutes an inch or any fractional part of an inch. They must all use measuring tools which insure quick measuring with the least possibility of error.

Johansson Gauges are the accepted standard of measurement the world over. They are the most simple known method of measuring and are guaranteed accurate to 0.00001″ at 68° F. They are self checking so that any inaccuracies due to accident or abuse are readily discovered. They not only answer the gauging needs for the present, but for the future regardless of how the work may change.

The new reduced prices of Johansson Gauges make them applicable as actual working tools in every machine shop.

Get fuller particulars from Aikenhead's. Write to-day.



Wahlstrom Automatic Tapping Attachment

THE Wahlstrom prevents the tap from jamming in the hole by keeping the lands free from chips—consequently there is no tap breakage. The chips are freed by an oscillating motion which duplicates the simple to-and-fro motion of hand tapping. For tapping in soft materials the oscillating motion can be changed to a continuous revolution.

Made in two sizes. No. 1 takes taps of all sizes from 5.40 to ½ inch standard. No. 2 takes taps from ¼ inch to ¾ inch.

Aikenhead Hardware, Limited

17 Temperance Street, Toronto, Ont.

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WAR TIME PRACTICE WILL NOT HELP IN THE PRESENT MARKETS

RIGHT now is the time when a man must show whether or not he has any qualities as a manager, salesman or financial adviser.

That is the opinion of one well-known Toronto manager, speaking to Canadian Machinery this week. Here is the way he figures it out:

"During the war we got a poor idea of what business amounted to. There was nothing in the way of real serious selling done. Now there may be some variation from that statement, but as a rule it will hold true. The shell business was not sold. It was taken away, and there was only one necessary thing to do, viz., produce good shells. Any lessons of the war were for those in the production department, and I think we are a better people industrially than we were before on account of the experience we gained in that way.

"Many firms that came into being since the war have a real situation to face now. In many cases they have not been in business long enough to have seen such seasons coming and developing as we are facing now. There is nothing unprecedented in the developments that we are face to face with today. Many of us have gone through the same thing before, and have managed to come out in fair shape recently, although sometimes more or less ruffled up.

"You may know there is a tremendous difference between producing, with the government taking the product away, and financing much of the work, and getting out on your own hook to produce, finance and sell a certain given line. That is where we have got to do real hard work now, and as I remarked before, right now gives a man a good chance to show what kind of managerial stuff he has in his system. Problems of financing and selling are, to my notion, the real tests of good business training and capacity. Give me the man who can adjust finances and keep the sales on the move and you can take over the rest of the organization."

GALT FIRM GETS THIS BUSINESS

The Exchange Rate This Time Worked in Favor of the Canadian Firm

Irritation over United States exchange hold-up has been the means of securing for Messrs. Goldie and McCullough Ltd., of Toronto and Galt, a large order for boilers and heavy machinery for the new municipal lighting plant at Murwillumbah, Australia. Several American machinery manufacturers tendered for the business. The order is an important one. Mr. A. McArthur, of the Empire Engineering Supply Company, Sydney, Australia, at present at the Walker House, had the satisfaction of booking this order, and is expected to throw other important trade to Canadian manufacturers.

Mr. McArthur is now in consultation with officials of the Canadian Manufacturers' Association, urging that organization to inspire greater activity among its members to take advantage of present opportunities and lay the foundation for a large volume of the Australian trade. The Antipodean Commonwealth now has a tariff of 40 per cent. against all importations foreign, with a preference in favor of Great Britain and such of her Dominions as are on the same plan as Australia with respect to white labor conditions. Mr. McArthur says that if Canadian manufacturers are prepared to quote reasonable prices in many lines of articles, Australia is in the market with a large volume of orders to be filled.

PROTECTION FOR THE STEEL MILLS

Case Presented by the Steel Co. of Canada at Hamilton Sessions

Some of the bigger interests from the financial standpoint which sent representatives to claim a continuance of tariff protection at the Hamilton session of the Tariff Commission were the Steel Corporation of Canada, the iron and steel industry of Hamilton, Dominion Foundries and Steel Limited, the flat glass industries, the Spirella Company of Canada, all the above being located in Hamilton, and the Canadian Yale and Towne Co., Ltd., of St. Catharines. The statement of the Steel Corporation of Canada as presented by Mr. Robert Robson, president, was an exhaustive one, and it followed out the attitude adopted by the large corporations in the same business in Nova Scotia and at Sault Ste. Marie. As Mr. Hobson put it, the tremendous advantages of the self-contained industries across the line make it particularly difficult for the Canadian plants to compete with them, and he had plenty of statistics to show that the steel industry in Canada is subject to keenest competition from United States producing units owing to greater capacity, shorter freight haulage, and convenience to markets. The general statements from the different iron and steel interests were consistent ones of growth, with increasing payrolls and larger output, but their contentions were also consistent in the claim that if they are to continue to fill the dinner pails of the workers they must have protection for their produce.

STEEL PRICES AT MARCH '19 LEVEL

Largest of the Independents Announce New Prices at Which They Will Sell

Pittsburgh.—Return of steel prices to the base established by the United States Industrial Board, March 21, 1919, developed here on Saturday, when the Jones and Laughlin Steel Company, the largest of the independent interests, adopted new selling rates on certain finished steel products.

This reduction, the first to be made by independents in the Pittsburgh district, will not affect the wages, it was understood, of the approximately 25,000 persons in the company's employ.

The new prices, which are effective immediately, are: Bars, $2.35; structural sheets, $2.45; plates, $2.65, base Pittsburgh. Adjustments will be made on the prices for wire and cold-rolled steel products.

Independent steel companies of the Youngstown district, employing about 30,000 workers, announced to-day they will meet the reduction of prices announced to-day by the Jones and Laughlin Company of Pittsburgh, the cut to be effective at once.

Heads of the three largest independent corporations here declared a readjustment in the cost of both coal and labor will have to follow. They said that wherever labor costs with the independents are higher than the United States Steel Corporation, the wages will have to be reduced.

MANY THINGS TO BE CONSIDERED

Mr. Hollinrake Says C.M.A. Urges Members to Keep On As Many as Possible

Discussing matters of unemployment, T. A. Hollinrake, a president of the Toronto branch of the Canadian Manufacturers' Association, reminds the public that anxiety is not confined entirely to those who are out of work.

"The attitude of the C.M.A.," says he, "has been favorable to Labor. We have a committee on industrial relations which is keeping in close touch with the unemployment situation.

"At the present time it is the C.M.A.'s policy to ask all members of the association to keep as many employed as possible, even if they might easily be able to dispense with them, feeling that at this time it is a necessary and wise action.

"The power situation has been heart breaking to employers. That condition might very well have agravated un-

STEEL & IRON PRODUCTS

Quality Service

OF EVERY DESCRIPTION

HAMILTON PIG IRON

Basic Malleable Foundry

STEEL AND IRON BARS

OPEN HEARTH STEEL SHEETS

RAILROAD TRACK MATERIAL

Angle Bars Track Bolts Tie Plates Tie Rods Spikes

SCREWS	WIRE	NAILS
Steel	Steel and Brass, Copper and	Wire
Brass	Bronze, Heavy and Fine,	Cut
Bronze	Bright, Annealed, Coppered,	Boat
Wood and	Galvanized, Tinned, Stranded,	Horseshoe
Machine	Steel and Copper Cable,	Shoe Nails
Screws	Barb, Woven Clothes Line	Tacks

POLE LINE HARDWARE

Pole Steps Cross Arm Braces Guy Clamps Guy Rods

WROUGHT PIPE	FORGINGS	LEAD PRODUCTS
Black Pipe	Car Axles	Lead Pipe
Galvanized Pipe	Shape and Drop Forgings	White Lead
Nipples	Carriage and Automobile	Shot
Couplings	Hardware	Putty

BLOOMS
BILLETS
PLOW BEAMS
ANGLES
CHANNELS

THE
STEEL COMPANY
OF
CANADA
LIMITED

HAMILTON MONTREAL

WIRE RODS
HORSE SHOES
FENCING
RIVETS
BURRS

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employment. But employers as a whole bore the brunt of the power shortage and kept on their men, even though idle.

"Unemployment depends on the state of business. And manufacturers are experiencing no little uneasiness because of the tariff question, luxury and business profits taxes. Manufacturers are hampered in many ways just now, and the result is not beneficial as regards unemployment."

PIG IRON TRADE

The iron market is at present the quietest in years, and prices are being determined by small transactions on the Philadelphia market. Some small sales were made during the past week by Eastern Pennsylvania makers, up to $44 for No. 2 plain (1.75 to 2.25 silicon), although the usual prices are from $41 to $43 furnace. Malleable is offered at $46, while basic, in absence of business, is nominal, but could be secured from eastern makers on a basis of $35 valley or $41.16 del.

Pig iron dealers in Chicago who have been familiar with the market for years say that the present situation is the quietest ever experienced. There is not only practically no inquiry, but it seems impossible to interest any one in taking either spot iron or future tonnages. The policy that is seemingly followed with furnaces is to go out of blast rather than continue production under present conditions. Three furnaces have blown out in the South Chicago district. Northern iron is nominally quoted at $46 and southern $42.

Basic iron is being offered by a valley merchant furnace in the Pittsburgh district at $35 and Bessemer and malleable at $37.50 a ton as compared with prices of a week ago. No. 2 foundry (1.25 to 1.75 silicon) is quoted at the same price as last week—$39.

Pig iron sales in the Cleveland district are mostly of a resale character. Furnace prices are difficult to determine because the producers are either not selling at all, or in very small quantities. Carload sales were made by producers during the week at $42, base Cleveland furnace, and $41, northern Ohio furnace.

The volume of resale iron on the St. Louis market is increasing. It has been stated by men long in trade that they have never seen such a rapid change from a period of seeming scarcity to one of large surplus. Agencies quote $42 for No. 2 (1.75 to a 2.25 silicon). This price however does not mean anything as it is not being realized on sales.

Production is being curtailed sharply as producers claim that costs have not declined materially, even despite the heavy cuts in coke prices and they are unwilling to pile iron at present levels.

Despite the fact that foundries have further curtailed production and trading is almost at a standstill, there is a more cheerful undertone in the Boston market. Dealers who had given up hope of selling first half iron before the first of the year now seem to think that some buying will take place before the middle of December. A Connecticut consumer bought 300 tons of resale Virginia iron at $47.26 del. for No. 2X 2.25 to 2.75 silicon, which is approximately $40 furnace base.

On the Buffalo market there is very little furnace iron moving and transactions in resale have diminished considerably. The selling price in resale is varied. One lot of 500 tons sold at $43, while another small lot sold at $40. One furnace has quoted $44 for 1.75 to 2.25 silicon foundry, but no sales are noted at this price.

Transactions on the New York market are principally in resale iron and these sales usually consist of not more than one or two cars each. Buffalo foundry has been resold during the past week at prices ranging from $38 to $42 Buffalo for 1.75 to 2.25 silicon grade.

In the Cincinnati district one furnace which has been out of blast has been relined and is again working.

The disposition seems to be not to produce iron at the present high costs. The Jenifer furnace has been blown out, which further reduces the output. A little tonnage is being offered by an independent furnace company for $38 for No. 2 foundry, but the majority of furnaces are holding the price at $42.

Scrap Metal Market

Sharp drops are noted in many districts in the scrap metal market, but the general opinion is that it has nearly reached the bottom and that after another dollar or two decrease it will settle to a definite level. Ten thousand tons of heavy melting steel, recently sold at $19.50, delivered Chicago. Consumers are taking practically nothing and quotations are largely nominal. Railroad offerings are moderate.

After a remarkable record throughout the summer, continuing after all the other grades had softened, No. 1 machinery scrap at last has dropped in the Boston market. During the week the situation changed from a small supply to a surplus which accounts for the drop of $6 and $8. The fallen market seems to have brought some new business. Several hundred tons were bought at $33, del.

Prices in iron and steel scrap have declined from $1 to $3 in practically all grades. Rerolling rails city wrought and stove plate have dropped from $2.50 to $3 a ton.

Heavy melting steel has declined and is now holding at $14 to $15 f. o. b. New York. Clean cast borings and machine shop turnings remain unchanged, as these materials are not accumulating as fast as most of the others.

On the Pittsburgh market the actual quotations are largely nominal and unchanged from those of a week ago. Small lots are available at from $3 to $4 a ton lower, but these represent surplus quantities that consumers have on hand and are trying to dispose of, apparently with very little success.

On the Buffalo market the price of scrap is still declining, with few sales being made. Many cancellations of old orders have taken place and some dealers are overloaded with stock as they failed to gauge the market correctly and kept on buying. Most grades show a decrease in price over the past week and heavy melting steel is now quoted at $19 to $20.

Sharp declines have taken place in the steel scrap market this week at Cleveland, owing to an absolute dearth of business.

The general impression is that the market is still far from the bottom and as a result cancellations are numerous. Heavy melting steel is down from $21.50 and $22 to $19 and $19.25, and other grades are similarly cut.

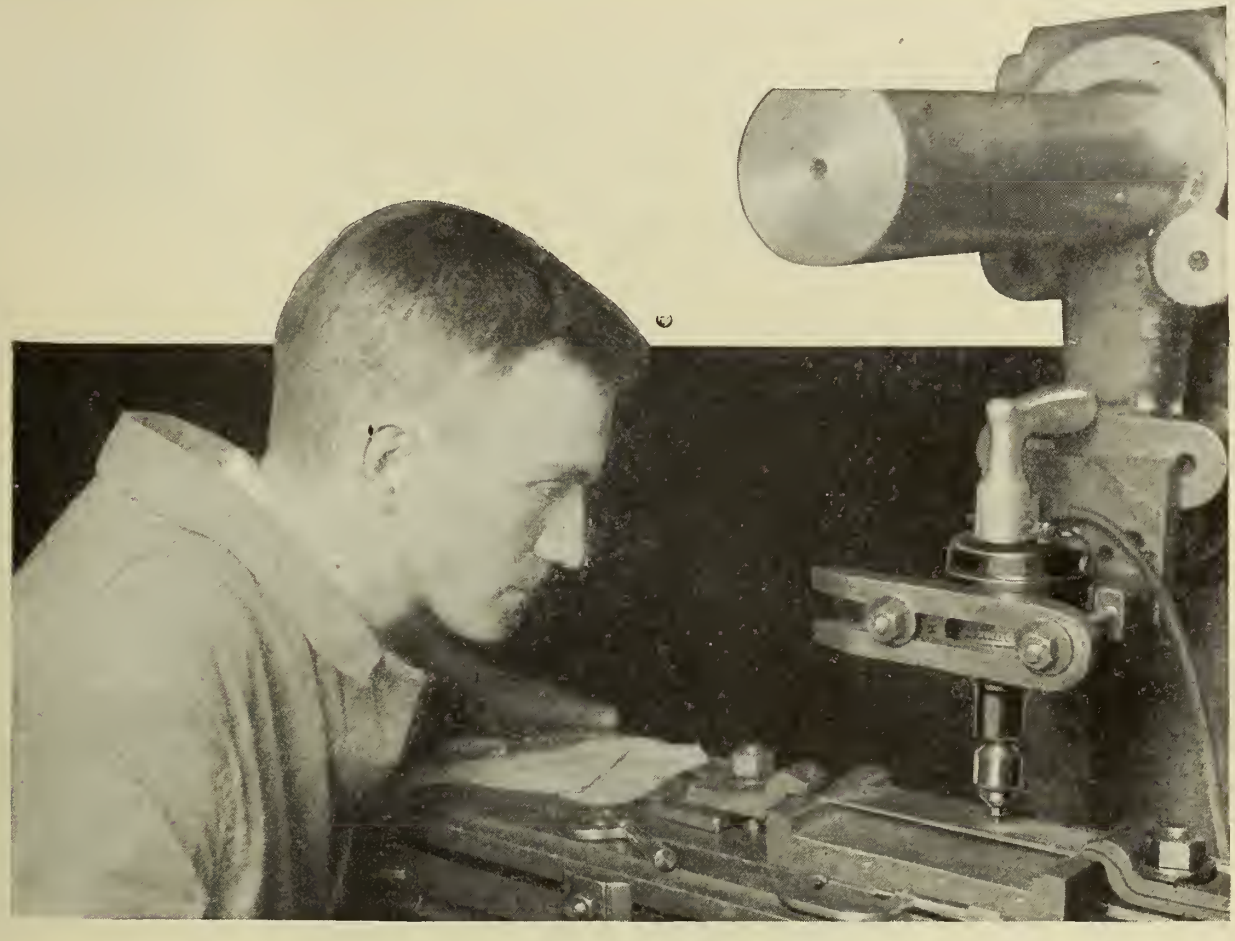
The market continues extremely dull at Cincinnati. Surpluses have been accumulated in some yards and this is largely responsible for the price slump.

On the St. Louis market re-rolling rails have been marked down from $22.50 to $20.50, compared with a price of $40 on September 12. Reductions, however, have failed to stimulate buying. Consumers are more interested in cancelling orders than acquiring new tonnages.

PERSONAL

W. H. Fairchild, city engineer of Galt since March, 1916, has handed his resignation to City Clerk McArney, to take effect December 31. When interviewed officially he gave no reasons for his action and said he had no plans for the future. During Mr. Fairchild's term of office, Galt launched its permanent paving programme and he has supervised construction of all the pavements laid to date. Citizens generally have been well satisfied with his work. It is understood an effort will be made to retain him.

On behalf of the office staff of the John Morrow Screw and Nut Company, of Ingersoll, the presentation of a handsome electric reading lamp to Mr. George Duncan, of Hamilton, of the company's sales force, took place at the office. Mr. Duncan, who formerly resided there, has been in the employ of the firm about fifteen years. He has severed his connection with the company to accept a position at Buffalo, being associated with J. Anderson Coulter, who recently purchased the plant of the Curtis Screw Company of that city.



Yankee Ingenuity Solves Drilling Problems with the Aid of this Dumore High Speed Drill

John Bath & Company, Inc. (Worcester, Mass.)—maker of fine tools—uses a half dozen each of Dumore Drills and Grinders in his up-to-date shop.

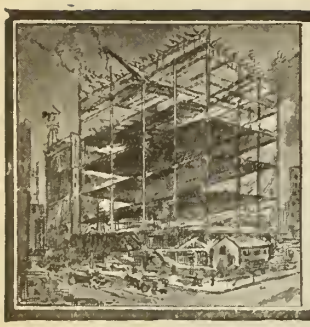
The Photograph shows a Dumore Drill mounted on the overarm of a milling machine drilling holes in a tool steel jig plate 1/8″ thick. There are 76 holes spaced .080″ apart in several rows and a drill .051″ in diameter is used.

Dumore Drills—like the well known Dumore Grinders—are accurately built, with an almost unlimited range of application. Used to supplement the work of big machines, Dumore High Speed Drills add to the capacity of the shop and cut production costs on many classes of work.

Send for the details of Dumore High Speed Drills and Grinders. Let us show you how you can use them to advantage.

WISCONSIN ELECTRIC COMPANY, 2930 Sixteenth Street - Racine, Wisconsin

DUMORE PORTABLE DRILLS



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



SAY THEY CANNOT TURN OUT IRON OR STEEL FOR SAME PRICE AS U.S.

REPORT from Sydney, N.S. speaking of the session there of the Tarriff Commission, says:

"Judging by certain statements which have been placed before the Tariff Commission by the coal and steel interests of this northern wing of the Province of Nova Scotia, the workingman plays a surprisingly big part in the problem of regulating the price at which the manufactured steel products of Canada are to be placed upon the market. There are three main natural resources which go into the making of pig iron, the basis from which steel is manufactured—the three being, the native iron ore, coal, and limestone used as a flux—so it would seem from the superficial viewpoint that the steel corporation which owns its iron mines, its coal mines, and its limestone quarries, should be in a position to turn out pig iron at a figure which would leave it quite without fear of the United States competition, and which would leave it totally unworried about the question of tariff. And yet, from what certain officials have told the Tariff Commission, the question is not so much the matter of a company owning its own mines as it is the labor problem. Protection against the American steel importations has been asked on the ground that the Canadian firms cannot turn out the finished product as cheaply as can the United States industries. Their cost of operation, they have contended, is much higher, and after that they come along and point out that fully 90 per cent. of the cost of turning out a ton of pig iron is made up by labor charges, while 80 per cent. of the cost of manufacturing a ton of steel is used up in the same way. So, getting back to the basis, the stand of the steel corporations of Cape Breton means that they are demanding protection from the Government because the wages of the workers are what they are. In this connection Senator Robertson, Minister of Labor, has made a number of efforts to learn just what the exact figures are in order that he may compare them with the wages paid in the United States and in the other steel and smelter industries in Canada, but so far he has gotten no farther than to bring out the claim that the wages paid by the Canadian coal operators are "probably" as high as those paid for mine labor anywhere.

WANT TO SELL CANADIAN PLATE

Competition in British Market Is Becoming Keen From Several Sources

Ottawa.—Cable advices from G. H. Flood, purchasing and contract agent of the Marine Department, who is in England looking into the market for Canadian steel plates, indicated that Canada will be able to dispose of but few of these plates in the mother country.

The government entered into a contract with the Dominion Iron and Steel Company to take a portion of the product of the Sydney plant and dispose of it. Consequently, the government is now trying to dispose of a portion of the 1921 output of the Dominion Iron and Steel plant, but Mr. Flood states that German and Belgian competition in the steel markets of Great Britain is now an appreciable factor, and that Canada will meet with strong competition.

While the Federal government is trying to dispose of steel plates, it is stated at the Marine Department that a contract for 2,500 tons of these plates for use on Hydro-electric construction at Niagara Falls will be filled in the United States.

The situation, therefore appears to be that, while the Federal government is seeking a market, plates for provincial work are being purchased in the United States.

PRESSED METALS HAS NEW MANAGER

Change Announced Whereby F. G. B. Allan Succeeds Mr. Leighton

A change is announced in the management of the Pressed Metals Company of Canada, Ltd. The announcement is made in the form of the following letter sent to the directors of the company by President C. E. Calvert, on behalf of the Executive:

"I beg to notify you that your Executive Committee has unanimously chosen Mr. F. G. B. Allan as general manager of the Pressed Metals Company of Canada, Limited, and American Bushings Corporation, succeeding Mr. J. W. Leighton.

"Mr. Leighton is now chief engineer and supervisor of works, and will devote the major portion of his time to the development of our patented bushings and tube processes.

"Mr. Allan's experience and qualifications should admirably fit him for the position of general manager."

Mr. Allan, who is a Toronto man, is a son of the late Hon. G. W. Allan of this city. It is expected that he will co-ordinate the various departments of the company in an effective manner. Mr. Leighton is the inventor of the bushings, which have been the principal product of the company. It is stated that the company has turned out between 2,000,000 and 3,000,000 for the Ford Company of Canada. The new factory at Marysville, Mich., constructed by the American branch of the Pressed Metals, has not yet started, but it is ready and it is said that the outlook for orders for it is excellent.

ENGINEERING

A permit has been granted to Dey Bros., Ottawa, Ont., to rebuild their rink on Gladstone Ave.

The Board of Education, London, Ont., are planning to build three high schools at a cost of $750,000.

The purchase of nineteen lots on Victoria Avenue, Niagara Falls, has been authorized by the public school board for a site for a new school.

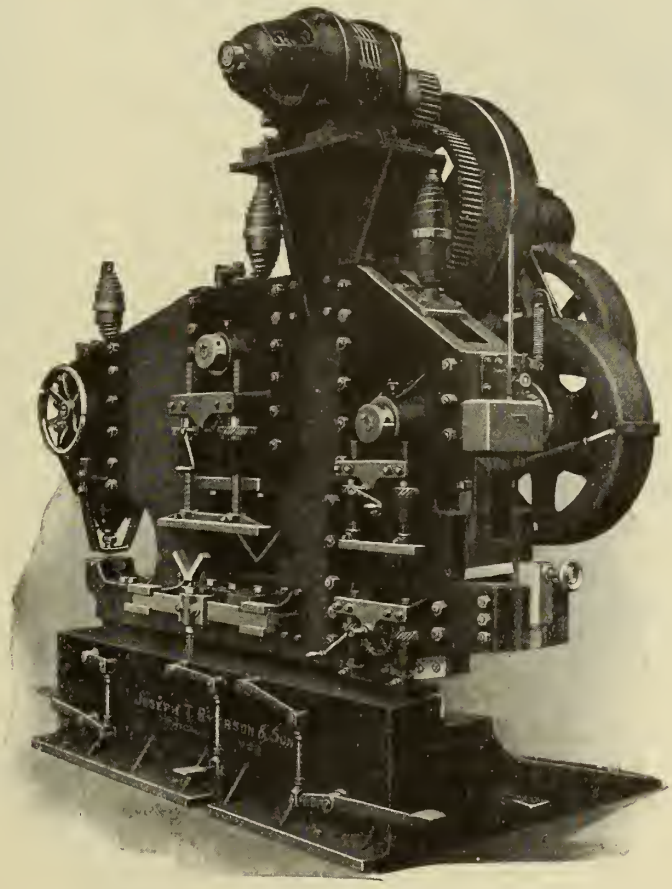
The board of trustees of Queens University, Kingston, have approved of the plans for the women's residence, and erection will begin in the near future.

The Laing Storage & Product Co., Brockville, Ont., are planning to erect an addition to their milk condensing plant next spring at a cost of $400,000.

The contract for the building of an axe factory to cost $50,000 for Mann Axe and Tool Co., Ltd., St. Stephen, N.B., has been awarded to H. K. Ferguson Co., Ltd. Temple Bldg., Brantford.

Steel Frame Quintuple Combination Punching and Shearing Machines

In Stock for Immediate Shipment



The Ryerson Steel Frame Quintuple Combination Punching and Shearing Machines embody five metal-working machines in one unit. These machines will handle the shearing of plates, round and square bars, coping and notching, section cutting and punching, without changing any tools or attachments.

We are manufacturing these machines in six sizes, with various capacities, covering a range of work from that of the ornamental iron and light structural shop to that of the heavy bridge-building plant.

Write for Complete Descriptive Bulletin

JOSEPH T. RYERSON & SON

CHICAGO, ILL., U.S.A.

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Canadian Representatives:

GARLOCK-WALKER MACHINERY CO., 32-34 Front Street West, TORONTO

MONTREAL **WINNIPEG**

If interested tear out this page and place with letters to be answered.

BE HONEST WITH YOUR CUSTOMER

George A. Simpson of Steel of Canada Delivers Address at Hamilton

Hamilton.—By establishing a spirit of confidence through fair play and truth with purchasing agents and buyers in general, salesmen could do more than any other class of men to stabilize present conditions, said George A. Simpson, special representative of the Steel Company of Canada, in addressing members of the Hamilton Commercial Salesmen's Association.

While he deprecated the talk of those who saw nothing but "blue ruin" ahead, Mr. Simpson emphasized the fact that service and co-operation on the part of salesmen were never more needed than at present. Business houses were keen to make new connections; prices were undergoing a change. Salesmen, therefore, should be men in whom all buyers have the utmost confidence. Salesmen should be big enough men to give counsel to buyers and tell the truth to the latter. If a salesman knew that a certain line of goods was going to decline in price, it was the duty of that salesman to tell a buyer so, and not allow the latter to stock up with a lot of high-priced goods that would clutter the shelves.

Service and Co-operation Always Pay

"The salesman who renders this spirit of service and co-operation will get his due reward without seeking it. The salesman who takes advantage of a buyer will, on the other hand, receive his penalty. Service and co-operation pay. They always have paid," concluded Mr. Simpson.

SIGNS OF PROGRESS

By-law will be submitted to ratepayers of Hamilton in January, 1921, authorizing the construction of an isolation hospital costing $500,000, and also a nurses' home costing $350,000 for the hospital board.

Additions are being made to the plant of Abitibi Power & Paper Co., Iroquois Falls, Ont., which, when completed in the early summer will double the capacity of the plant and will turn out almost 500 tons daily.

For the first ten months of the year the value of construction for the city of Regina, Sask., amounted to $10,766,526.

The City of Sault Ste. Marie, Ont., is planning the purchase of land on the outskirts of the city with the idea of erecting an airdrome.

The Three Rivers Pulp & Paper Co., Ltd., at Three Rivers, Que., have awarded the contract for the building of the entire plant, including docks, etc., to William I. Bishop Ltd.

Permission has been granted to Geo. A. Morgan to erect a public garage and show room on the southeast corner of St. Clair and Bathurst Streets, Toronto, at a cost of $45,000.

The tenders received for the construction of the Livestock Arena, Toronto, have far exceeded expectations, and a committee will study the plans with a view to reducing the cost.

The Imperial Oil Co. has awarded the general contract for the erection of a service station costing $15,000 at 56 Church Street, to John V. Gray Construction Company, 541 Queen Street E.

A large addition will be erected to Annesley Hall (women's residence) next year for Victoria University. A residence for men will probably be erected soon on grounds north of Knox College.

FIRMS THAT ARE ASKING FOR TRADE OPENINGS WITH CANADA

By communicating with this paper and mentioning key numbers, information can be obtained by firms interested in the following lines:

2323. Metal Sheets.—A Port Elizabeth firm of manufacturers ask for quotations on regular supply of metal sheets in plain and corrugated galvanized iron, black, iron, zinc, brass and copper.

2324. Machinery and Supplies.—A Portuguese East Africa firm with headquarters at Lourenco Marques, P.E.A., ask for correspondence from Canadian engineering firms prepared for export in machinery and supplies relative to tramways, electric lighting and waterworks enterprises.

2325. Building Materials, Bar Lron, Wire, Plain and Barbed.—A Cape Province firm specializing in builders' supplies request catalogues, price lists and correspondence from manufacturers prepared to export.

2326. Foundry Requisites. A Johannesburg firm makes inquiry for correspondence and other data from manufacturers of foundry requisites.

2327. Iron and Steel Goods.—A Port Elizabeth, Cape Province, firm of importers request offers of catalogues and price lists from manufacturers exporting bar iron, galvanized iron, fencing wire, wire nails, general hardware and steel goods of all kinds.

2329. Engineers' Tools.—A Durban importer of the above line asks for catalogues and correspondence from Canadian manufacturers.

2331. Wire.—A Durban manufacturer with branch factory in Johannesburg is open to buy Canadian wire, all grades, including copper, brass, nickel, steel, plain, galvanized and tinned wire.

2334. Tools.—A Johannesburg firm requests catalogues and price lists for tools of all kinds, suitable for hardware department. Catalogues for spades and shovels are also requested.

Firms interested in the following lines can obtain information by communicating with this paper and mentioning key numbers:

2392. Merchants' Bars. — A Buenos Aires firm of importers, with a buying house in New York, would like to receive quotations from manufacturers of merchants' bars, all sizes and shapes.

2393. Hardware, Agricultural Implements, Automobile Accessories.—A Port Elizabeth firm specializing in the above lines will be glad to receive Canadian catalogues and price lists.

2397. Hardened and Tempered Steel Ribbon.—A large British house in Yokohama is anxious to give orders to Canadian manufacturers of spring ribbon, specifications of which must be as follows:

Size ¾in x .017 in.

Color of finish—preferably blue.

Carbon—.9 to 10 per cent.

Temper 7 quality—as per sample sent to Department of Trade and Commerce.

Any firm in a position to make this steel ribbon may obtain the sample at the Commercial Intelligence Branch, Ottawa.

2380. Agricultural Specialties. — A Johannesburg firm of engineering agents and importers are prepared to take up any special line suitable for this trade. Correspondence with catalogues and all other details is requested.

2381-2383. Agricultural Implements.—Three Johannesburg firms specializing in agricultural machinery invite correspondence to include catalogues and price lists from agricultural implement manufacturers and exporters in Canada.

2391. Mining Material.—A Johannesburg engineering firm are prepared to purchase or handle as agents any line of mining material or machinery.

IS THE WORLD OIL MAD?

According to Sir John Dimsdale, who arrived in New York a few days ago, this condition really exists. He is on his way to Trinidad to inspect the oil wells there, of which he is a director. "The world is oil mad" he said, "and we shall depend more and more upon it for fuel as the supply of coal diminishes." It is a peculiar coincidence that such a statement should be made about the same time as the C.P.R. are changing over from fuel oil to coal owing to the scarcity of oil. The world may be oil mad, but perhaps the reason they are mad is because they cannot get the coal.

The most interesting improvement in the use of substances, that shows overheating of bearings by color, has been made by Pinnock, says the Scientific American. A mixture of 85 per cent. of copper mercuric iodide with 15 per cent. of silver mercuric iodide is very sensitive to heat and gives a very sharp transition from vermilion to almost black at 60 to 70 degrees Centigrade (108 to 126 Fahr.). To apply to bearings the material is mixed with white shellac spirit varnish in the proportion of 100 parts of color compound to 70 parts of the varnish. After painting a spot or band on the background of zinc white it is given a protective coating of colorless oilproof varnish.



High Speed FORGED Drills

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Set Screws
Cap Screws
Semi-Finished Nuts

If you require Special Screw Machine parts send us your samples. We can probably save you money.

Order By the Name MORROW It Makes You Safe

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1290 Homer St.

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Upon the Health of your employees depend your profit and production



Don't be contented with half-way goodness or makeshift drinking arrangements.

Throw out the germ-laden Drinking Cup!

Give your men a clean drink

PURO SANITARY DRINKING FOUNTAIN

(MADE IN CANADA)



Allows just the proper amount of cool, clean fresh water to come through the bubbler. No spurting, overflowing, no loss. "Puro" regulates itself. "Puro" saves 35% on water bills, too. You can attach it in a few minutes. Tell us how many men, how many departments and we'll tell you how much the cost will be.

Puro Sanitary Drinking Fountain Co.

Canadian Agents:

McKENZIE BROS.

888F St. Andre St., Montreal, P.Q.

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Write for Prices

Superior Machinery Co., London, Canada

"Maple Leaf" BRAND

Stitched Cotton Duck Belting

"Maple Leaf" brand costs less than leather, rubber and balata; has a positive grip on the pulley and is true running.



Have us send you samples and see just why "Maple Leaf" sets the standard in economy, strength and durability.

Dominion Belting Co. Ltd.

Hamilton, Canada

Quebec Branch: 51 Duluth Bldg., Montreal



No. 4 Press 10 to 12 tons

Write for complete information on Atlas Arbor Presses. All sizes for all purposes.

ATLAS PRESS CO.

330 N. Park St.

Kalamazoo, Mich., U.S.A.

Canadian Representatives:

Chas. A. Strelinger Co., Windsor, Ont.

RUBBER BELTING

THE ROBERTS & ABBOTT CO. TORONTO

WIRE SPRINGS OF ALL KINDS

Machine Springs, Valve Springs, Automobile Cushion Springs, etc., of a quality that defies competition. Tell us your requirements. Send sample or specification for price.

JAMES STEELE, LIMITED

GUELPH, ONTARIO

MARINE ... ...

Cleveland.—Coal shippers are in the market for tonnage, but there is little demand in other lines. Ore shippers are doing good these days, and a few cargoes will be moved in December. No more boats of the Pittsburgh Steamship Co., however, will be sent back for ore, but a few steamers may take coal.

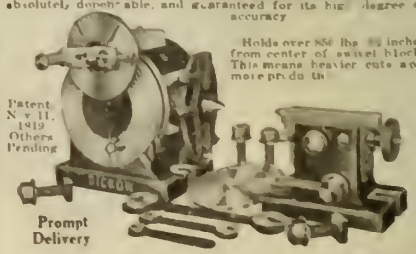
Last Saturday the Canadian Vickers Company launched another 8,300 deadweight freighter for the Canadian Government Merchant Marine. This is the sixth vessel built for the National fleet this summer and the twelfth since the establishment of the C. G. M. M. The boat is one of the largest type, being 413 feet in length, 52 feet beam and 31 feet deep. When loaded she will have a draft of 25 feet 3 inches. She is fitted with triple expansion engines and Scotch boilers equipped with forced draft system. The launching ceremony was performed by Mrs. W. G. Ross, wife of the president of the Montreal Harbor Commissioners.

Kingston.—The steam barge John Randall has been given up for lost on Lake Ontario. The vessel has been missing since last Tuesday and no trace whatever has been secured of her. A lifeboat marked "Wanderer" floated into Sackett's Harbor, and it is believed to have been used by one of the members of the crew, although it was not known in local marine circles that the Randall had any equipment of the old steamer Wanderer, which has been laid up. The Randall is believed to have gone down between Stony Point and Point Peninsula. She had two lifeboats, one of the wooden type and the other metal.

OTTAWA.—The two ships at Toronto which were under construction for the Government by the Dominion Shipbuilding Company when that concern went into liquidation are to be finished by the Collingwood Shipbuilding Company. A contract with the Marine Department is being concluded. The Collingwood Company, it is understood, will do the remaining work on the basis of 15 per cent. of the actual cost. No extension of the shipbuilding programme is now contemplated. By the spring the entire fleet of about sixty steamers will be in commission, and these, it is believed, will be adequate for requirements for some time at any event.

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Trade Gossip

Coal Supply Easier.—With the arrival of colder weather officials of the Railway Commission at Ottawa, who are handling fuel control and distribution, are not apprehensive as to supplies, if the early winter weather proves reasonably good.

Have Moved Offices.—The Precision & Thread Grinder Manufacturing Co. have moved their offices to 1 South 21st Street, Philadelphia, Pa. At this new location they will maintain a machinery display department, showing in addition to their grinders the Craley master tool-maker, Miller radius and angle wheel dressers for tool room and production work, the Herrmann snap thread gauges, and other tools and accessories.

Reductions Made.—Effective December 1st, there will be a reduction in the payroll of the G. T. R. shops of 20 per cent. This reduction will be made in two ways. The wages will be cut 10 per cent. and the remainder of the necessary 20 per cent. reduction in the payroll met by laying off of men. Mr. J. C. Garden, the superintendent, in speaking about it, said that as yet he could not say just how many men this would affect. They were just figuring on the 10 per cent. in wages so far. Should it mean a straight cut of 10 per cent. in the staff it would mean laying off about ninety to one hundred men.

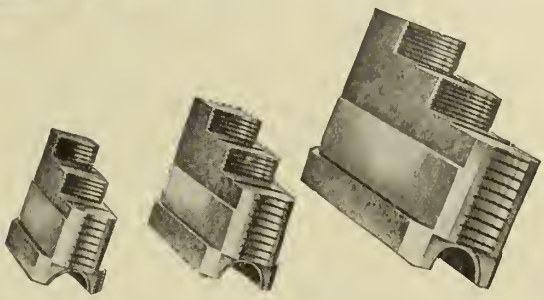
C. N. R. Repair Shop.—A Fort William report says: "Work is progressing favorably on the construction of the new Canadian National car repair shop at the Mission, for which J. H. Simmons, of Winnipeg, has the contract. The building, which was started about three weeks ago, will be, when completed 300 feet long by 50 feet wide and 22 feet high. The concrete footings are now all in place, and work will be pushed on till the building is finished. The building, when finished, will be well lighted, and the Canadian National railways will fit it up with modern machinery necessary for taking care of the most complicated repair work."

To Give Bounty.—Incorporation of the Coast Range Steel, Ltd., with a capital of $15,000,000, and controlled by British capital, is granted, and it is the intention of the company to erect an iron and steel plant with blast furnaces, on the lower mainland of British Columbia. Plans provide for the ultimate expenditure of $50,000,000 in the establishment of a great iron and steel industry, and it is the intention to start active construction within six months. Engineers have been in the province for two months making a survey of the situation. Vancouver men named provisional directors are H. J. Landahl, Fred T. Congdon, J.D., Kearns, John Steta and Major Montague Moore. The provincial government has approved the project and will pay $3 a ton pig iron production bounty.



DOMINION CHUCKS

STEEL OR CAST-IRON BODY
BUILT FOR HEAVY DUTY



The Jaws Are Extra Strong

THEY are drop forgings, made of best quality steel, heat-treated and hardened. The threaded portion of jaws form a half nut for the setting-up screws. Have stood the test of heavy duty work in our own shops where accuracy was the only accepted standard.

DOMINION STEEL PRODUCTS CO.
LIMITED
Engineers • Manufacturers
BRANTFORD, CANADA

3

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ATTORNEYS

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The old established firm. Patents everywhere. Head office, Royal Bank Bldg., Toronto. Ottawa office, 5 Elgin St. Offices throughout Canada.
Booklet Free.

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LIMITED
Consulting and Designing
Tools, Jigs, Fixtures and Special Machinery. Let us shoulder your problems.
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MARION & MARION 364 University St.
Merchants Bank Building, corner St. Catherine St., Montreal. Phone Up. 647, and Washington, D.C., U.S.A.

MACHINERY SUPPLIERS
MANUFACTURERS REQUIRING MACHINERY can with advantage obtain speedy delivery, through our Surplus Plant and Machinery Dept., constituted some years ago for the handling of Surplus Plant, of Boiler Works, Ship Yards, Engineering Works, etc. New or Good Used Plant as required. Please send enquiries. Pillatt & Co., Ltd., Stapleford Iron Works, Nr. Nottingham, England.

HIGH CLASS Machine Tools
FOR SHIPYARDS AND CONSTRUCTIONAL WORKS
BERTRAMS LIMITED
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BLACK DIAMOND OVENS
OVENS
Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.
Brantford Oven & Rack Co. Ltd.
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DROP FORGE DIES
Send us your blueprints and specifications. Entrust your requirements to experienced workmen and up-to-date equipment. Have your dies made in Canada. First-class workmanship guaranteed.
THE KIMBER & HILLIER MFG. CO.,
Thorold Road, St. Catharines, Ont.

Classified Opportunities

AGENCY OPPORTUNITIES

WE ARE FREQUENTLY ASKED TO SECURE representatives for manufacturers in Canada, Great Britain and the United States. From time to time we shall publish particulars regarding agencies available and correspondence is invited. If the information has not been previously supplied please give particulars regarding experience, sales organization, territory, etc.

AMERICAN MANUFACTURER OF SANITARY drinking fountains who has made arrangements to have his line manufactured in Canada wishes to get in touch with a man who can sell the appliance in industrial plants of all kinds. Box 730A, Canadian Machinery.

AMERICAN METALLOGICAL ENGINEERS and manufacturers of case-hardening compounds are anxious to be represented in Canada by responsible, aggressive party. Correspondence invited which will be treated as confidential. Box 736A. Canadian Machinery.

MANUFACTURER OF SAND MIXERS WISHes to secure aggressive representation in Canada. Box 733A, Canadian Machinery.

HIGH SPEED STEEL MANUFACTURER wants Canadian representation. Box 732A, Canadian Machinery.

AMERICAN MANUFACTURER OF CORE compounds, etc., wants Canadian agency connection. Box 731A, Canadian Machinery.

AMERICAN FIRM MANUFACTURING PATented process case hardening specialty wants the services of party capable of building up sales in Canada. Box 706F, Canadian Machinery.

CANADIAN REPRESENTATIVE WANTED by U.S. manufacturer of well known line of high speed and alloy steels. Correspondence invited and will be treated as confidential. Box 707F, Canadian Machinery.

FOR HIGH-GRADE AMERICAN-MADE LATHE —14 to 26. In replying state territory you can cover and cover thoroughly. Box 682, Canadian Machinery.

MACHINERY FOR SALE

1—26" x 12' Pond Engine Lathe.
1—21" x 10' London Engine Lathe.
1—18" x 8' London Engine Lathe.
2—18" x 8' C.M.C. Engine Lathes.
1—14" x 8' London Engine Lathe.
1—16" Pierce Turret Lathe.
1—16" Acme Turret Lathe.
1—No. 2 Gardner Disc Grinder.
1—No. D-1 Colburn Heavy Duty Drill.
1—16" C.M.C. Shaper.
1—No. 320 Brown-Boggs Press.
3—No. 1 Racine High-speed Saws.

These machines have all been put in first-class working condition.

Write us for particulars and prices.

Yeates Machinery, London
Hale St., London, Ont.

FOR SALE

ENCLOSED LIQUID FUEL COMBUSTION APparatus capable of generating intense heat in pipes and confined passages for heating parts of internal combustion engines and for other uses; spark ignited; blower operated. Patented October 8th, 1918. Can be inspected at and for sale by H. W. Petrie, Limited, 131 Front St. W., Toronto.

FOR SALE—ONE BURY AIR COMPRESSOR, 12 x 14, Class M, 330 cub. ft. per minute, belt driven, only slightly used, $750; one air compressor tank 42 in. x 8 ft., man-hole on top, two 4½ in. side openings and one 2 in. side opening, $100. Taylor-Forbes Co., Ltd., Guelph, Ont. (c23m)

ONE 24-IN. DIA. x 48-IN. STROKE SIMPLE horizontal side crank Corliss steam engine, with 20-ft. x 25-in. flywheel and outboard bearings, made by Wood, Bolton, Eng.; one Northey jet condenser, 10-in. steam inlet, 8-in. water inlet, and 8-in. outlet; one London Machine Tool Co., 24-in. x 24-in. metal planer, single head, 6-ft. table, power cross feed, hand vertical feed and countershaft. Apply The Nova Scotia Underwear Co., Ltd., Windsor, N.S. (c24m)

FOR SALE

Perfected rotary engine valve, simple design, free from defects common in rotary valves. Patented Feb. 20, 1917. Can be inspected at and purchased from H. W. Petrie Limited, Toronto.

FOR SALE

Enclosed liquid fuel combustion apparatus capable of generating intense heat in pipes and confined passages for heating parts of internal combustion engines and for other uses; spark ignited; blower operated. Patented April 3, 1917. Can be inspected at and for sale by H. W. Petrie, Limited, Toronto.

Central Machine & Tool Co.

30 Widmer Street, Phone Adelaide 3898,
Cor. Adelaide and Widmer St., Toronto.
Machinists, special machinery made to order, repairs, cylinder grinding, pistons, rings and wrist pins. Satisfaction guaranteed.

CASTINGS

Medium and light, grey iron castings for manufacturing purposes. We carry bushings, solid and cored, from 1 in. to 6 in., or larger.

TORONTO FOUNDRY CO.
1884 Davenport Road, Toronto
(c31m)

MACHINERY BARGAINS

1—15" Hendey Pillar Shaper.
3—3" x 36' Jones & Lamson Turret Lathes
1—18" x 8' Stevens Lathe, D.B.G.
2—18" x 8' Mueller Lathes, D.B.G., Q.C.G.
1—26" x 12' C.M.C. Lathes, D.B.G., Q.C.G.
1—32" x 24' Engine Lathe.
5 Gross 10" Victor Power Hack Saw Blades.

Price—List less 25%

CHARLES P. ARCHIBALD & CO.
Machinery and Supplies
285 BEAVER HALL HILL MONTREAL

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W. H. Sumbling Machinery Co., Toronto. (ctfm)

MACHINERY WANTED

WANTED—ONE 10 H.P. GENERAL ELECTRIC or Westinghouse motor, 60 cycle, 3 phase, 440 volts, 1200 R.P.M. The Frost & Wood Co., Ltd., Smith's Falls, Ont. (c24m)

WANTED — WOODWORKING MACHINERY and mining machinery, machine tools, boilers, and steam pumps, alternating or direct current motors. Contractors' equipment. Apply Box 737F, Canadian Machinery.

Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

SALESMEN WANTED

Must be thoroughly familiar with the Foundry and Coal Mining Trade. Box 719 F, Canadian Machinery.

For Sale

One 52-inch John Bertram & Sons Co. Boring Mill, late pattern, with two heads on the cross rail, with independent jaw chuck built into the table, arranged for motor drive using ten horse power motor, without motor.

In use at the present time on very fine class of work. Price $6,450.

Box No. 729. Canadian Machinery. (C23M).

Classified Opportunities

MACGOVERN & COMPANY INCORPORATED POWER MACHINERY

D.C. MOTORS

220/250 Volts

H.P.	Make	Speed	H.P.	Make	Speed
½	WESTINGHOUSE	1000	30	GENERAL ELECTRIC	975
¾	DILG ACME	2500	30	WESTINGHOUSE	975
2	TRIUMPH	1750	35	CROCKER WHEELER	700
3½	WESTINGHOUSE		35	GENERAL ELECTRIC	540-1080
5	BULLOCK	900	35	CROCKER WHEELER	900
5	GENERAL ELECTRIC	1100	35	ELEC. DYNAMO CO.	560
7½	WESTINGHOUSE	850	40	SPRAGUE	800
7½	ALLIS CHALMERS	600	40	GENERAL ELECTRIC	600
10	PEERLESS MFG. CO.	590	40	WESTINGHOUSE	600
10	WESTINGHOUSE	1250	50	GENERAL ELECTRIC	560
12	AMERICAN ENGINE CO.	1170	50	CROCKER WHEELER	830
15	SPRAGUE	1500	50	IMPERIAL	1000
15	STURTEVANT	800	55	ALLIS CHALMERS	550
15	GENERAL ELECTRIC	1200	60	CROCKER WHEELER	625
15	WESTINGHOUSE	1675	75	WESTINGHOUSE	800
15	CROCKER WHEELER	800	75	WESTINGHOUSE	475
15	GENERAL ELECTRIC	625	80	GENERAL ELECTRIC	750
20	CROCKER WHEELER	775	90	WESTERN ELECTRIC	525
20	GENERAL ELECTRIC	975	100	GENERAL ELECTRIC	720
20	WESTINGHOUSE	975	100	WESTINGHOUSE	700
20	SPRAGUE	1250	120	GENERAL ELECTRIC	450
20	FT. WAYNE	660	125	CROCKER WHEELER	650
25	WESTINGHOUSE	825	150	SPRAGUE	1050
25	GENERAL ELECTRIC	560	160	GOODMAN ELEC. CO.	420
25	CROCKER WHEELER	775	165	NORTHERN ELECTRIC	300
25	BULLOCK	600	175	BULLOCK	625
30	WESTINGHOUSE	400-1500	200	WESTINGHOUSE	560
30	BULLOCK	600	250	CROCKER WHEELER	130

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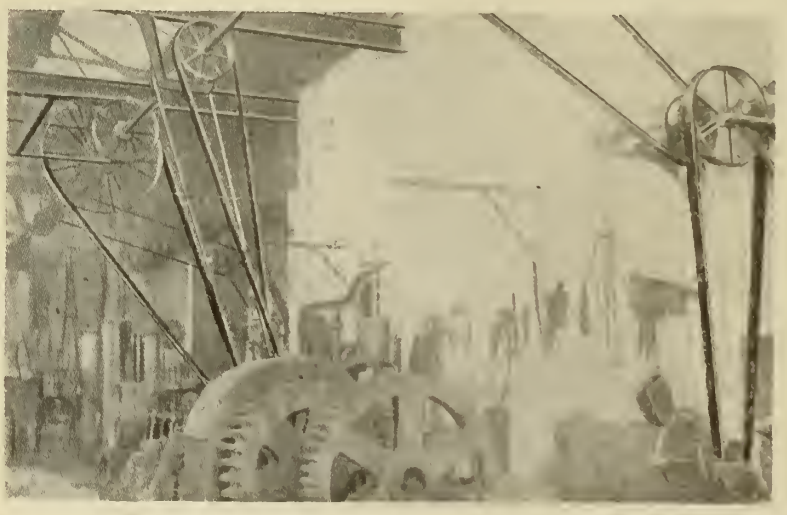
MACHINE SHOP—5-Storey concrete (brick encased), 100 ft. x 50 ft.
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Driving Heavy Machine Tools

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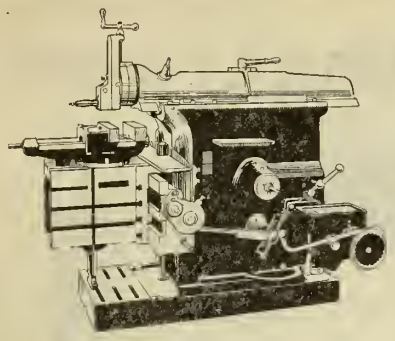
These beltings will solve your driving problems and save you money

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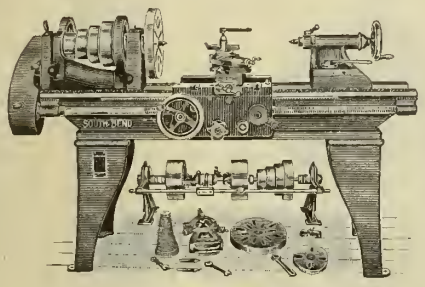
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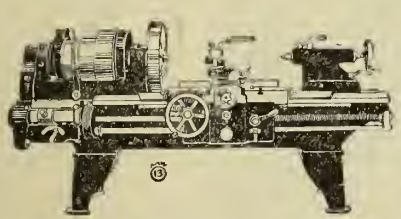
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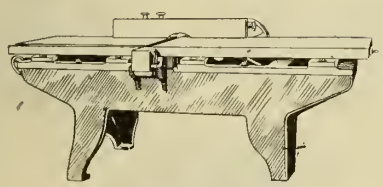
24 in. Gould & Eberhardt Shaper



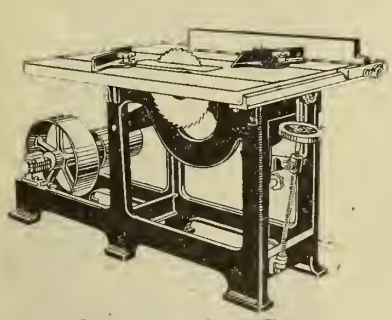
16 x 8 South Bend Lathe



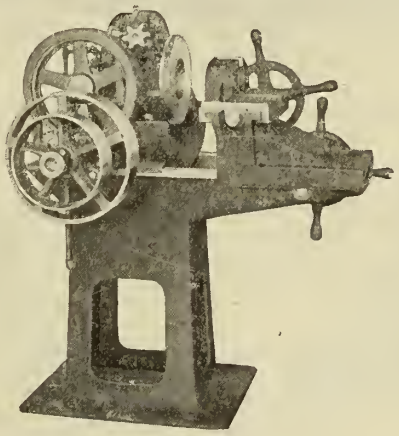
19 x 8 LeBlond Heavy Duty Lathe



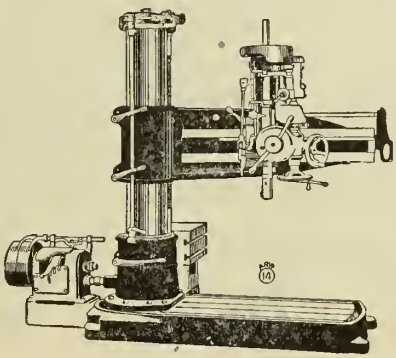
12 in. Buss Planer



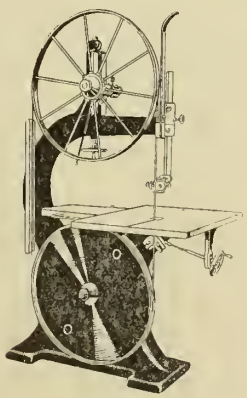
Tilting Top Saw Table



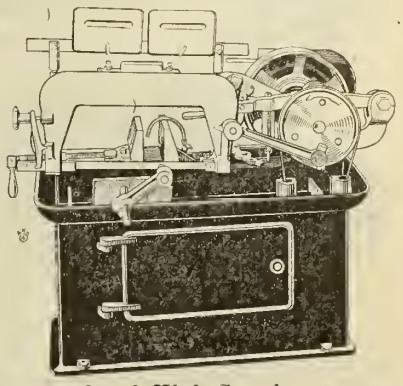
4 in. Pipe Machine



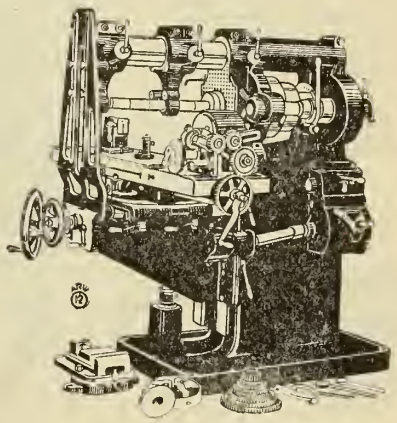
4 ft. Fosdick Radial Drill



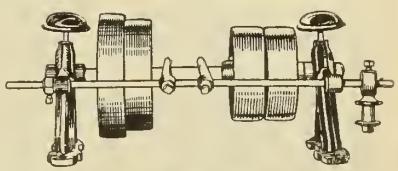
36 in. Band Saw

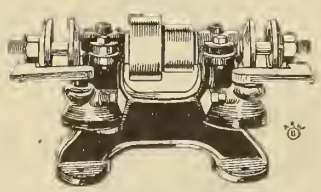


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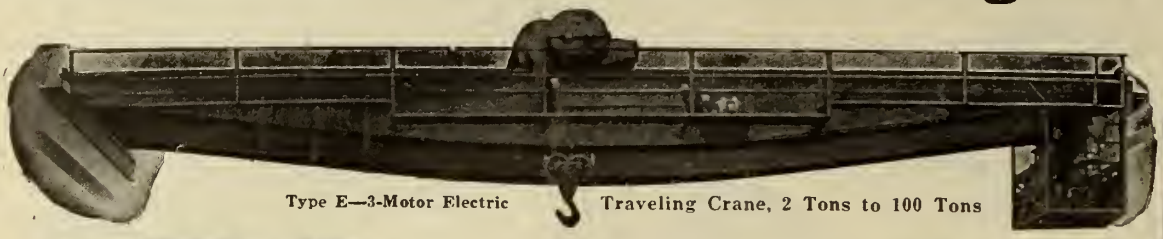
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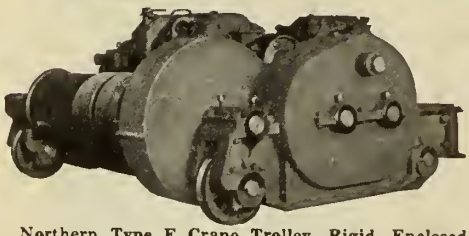
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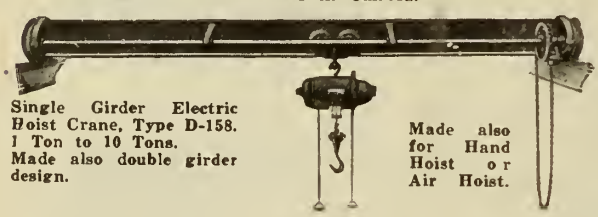


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Made also for Hand Hoist or Air Hoist.

Get our prices and specifications before you buy.

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Northern Crane Works, Limited

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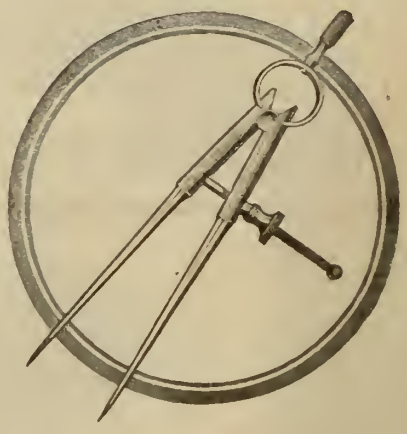
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"--when typewriters were curiosities."



Forty years ago, when the typewriter was still a "new-fangled contraption", machinists were beginning to learn what so many thousands know today—that Starrett Tools are made to insure complete satisfaction to the men who use them.

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If you're interested in fine tools write for a copy of Catalog No. 22"3."

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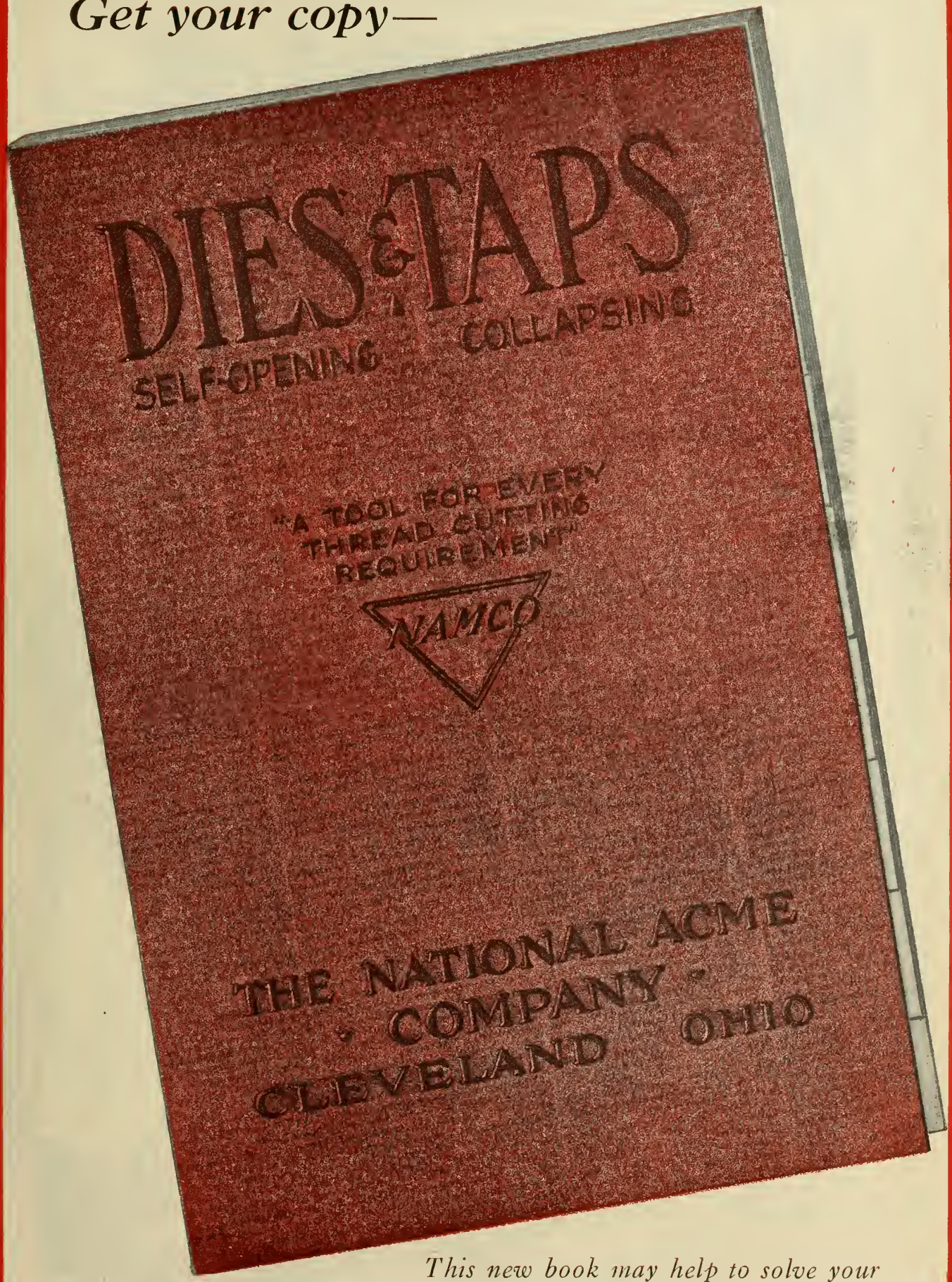
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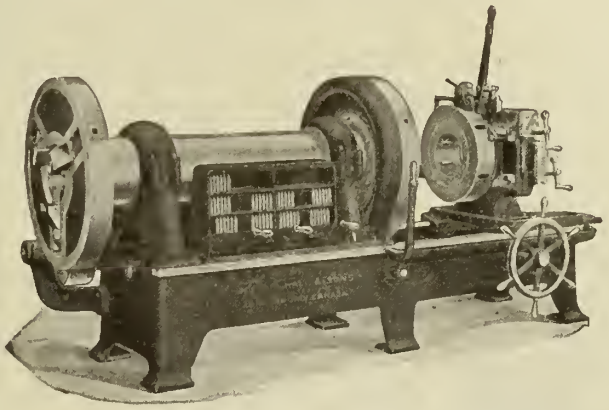


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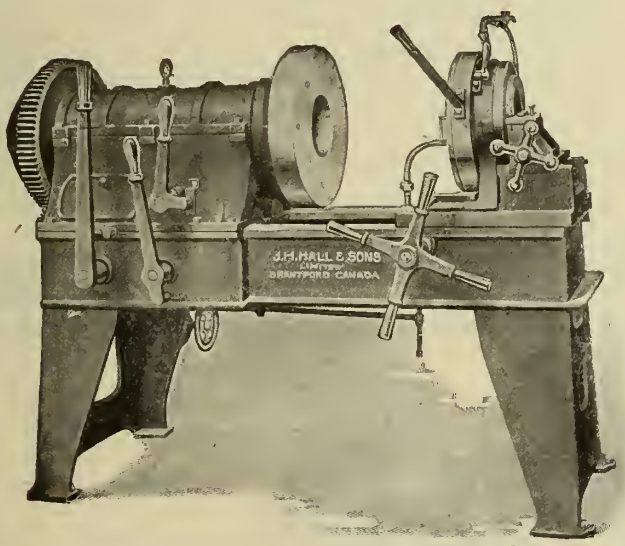
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No. 8 Hall Duplex Improved Pipe Machine



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Hall machines are designed to allow the utmost freedom and ease to the operator. The front and operating side of the machine is left perfectly free and the machine is under complete control from the operating side at all times. The time-saving value of this is obvious.

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Successors to John H. Hall & Sons, Limited

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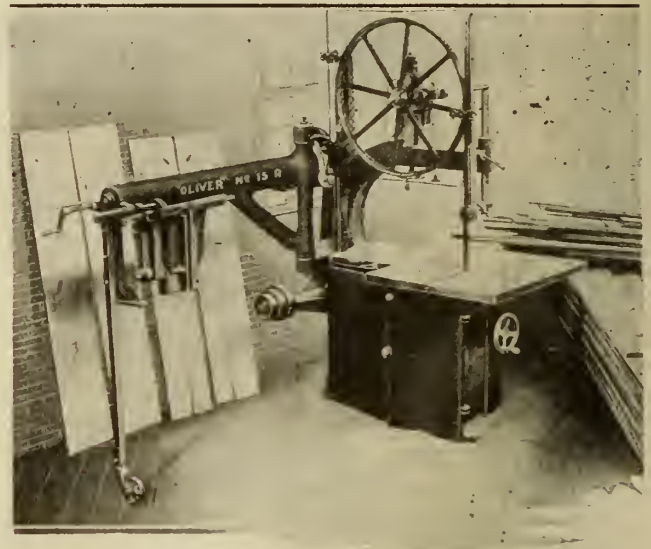
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Office and Warehouse:
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The above photograph shows one of the many installations of a general utility machine of more than ordinary merit. The first function of the "Oliver" Band Re-saw is to save lumber. But time is worth saving, too. The "Oliver" Band Re-saw is equipped with safety guards that eliminate danger of accidents to the utmost.

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Where strength and dependability are requisite specify Williams' "W & B" Machinists' Knife Handle Wrenches. Fitted with easy-acting screw. At your dealers. Write for catalog.

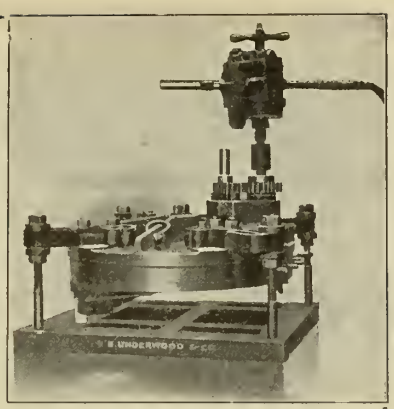
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The planer is rigidly constructed to stand heavy work without spring or strain. It will easily plane as heavy a cut as is required in valve seat work. Full particulars of this or any other Underwood machine will be forwarded upon request.

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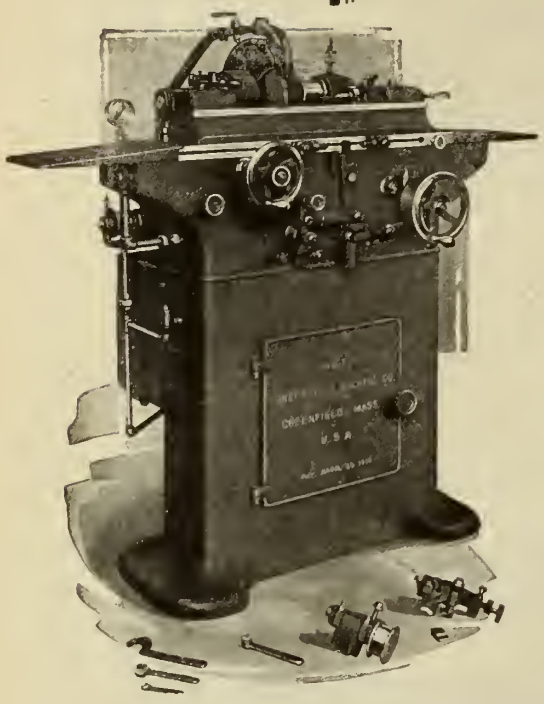
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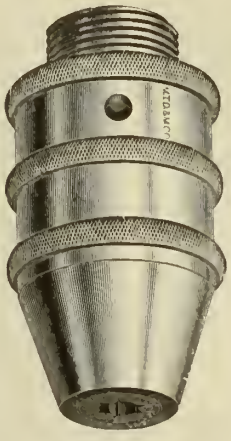
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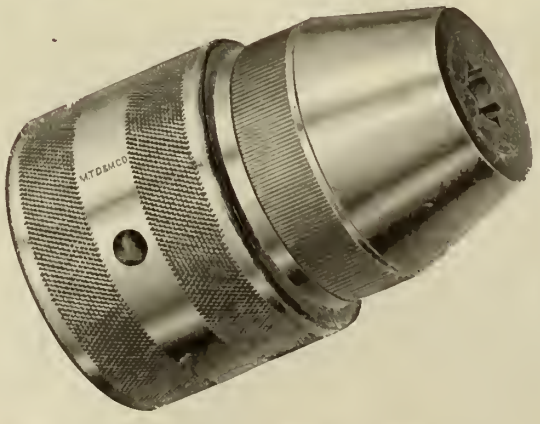
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Greenfield Machine Co.
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Lasalle 508

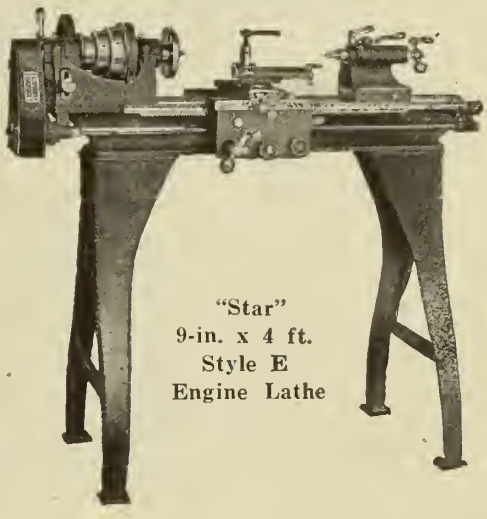
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STAR LATHES

Announcing the Consolidation of Two Well-Known Firms



"Star"
9-in. x 4 ft.
Style E
Engine Lathe



Adams
Short-Cut
Lathe

We are pleased to announce the consolidation of the O. R. Adams Mfg. Company with The Seneca Falls Mfg. Company, Inc.

These two firms have long been recognized as leaders in the manufacture of small tool room and production lathes. In the future the combined styles of the two will all be made, the consolidated firms operating under the name of "The Seneca Falls Mfg. Company, Inc."

Full particulars of all lathes will gladly be sent.

THE SENECA FALLS MFG. CO., INC.
366 W. Falls Street Seneca Falls, N.Y.

New York Office and Permanent Exhibit, Grand Central Palace, New York City

If interested tear out this page and place with letters to be answered.



A Tank That Couldn't Be Put Out of Business

In a recent conflagration, this 12,000 gallon oxy-acetylene welded oil tank is practically all that was left of two burned-down business blocks.

Not only did it withstand terrific heat, but also the shocks of dropping five feet and of having roof and floor beams crash upon it.

The ruggedness of this tank is another tribute to

Prest-O-Lite

DISSOLVED ACETYLENE

"The Universal Gas with the Universal Service"

as an important factor in the efficiency of the oxy-acetylene process.

The domed head was bent in, the 5-inch oxy-acetylene welded supply pipe held fast—without a leak—despite the fact that half the weight of the tank hung upon it, even after all the dents were straightened out the welds held tight.

You will be interested in the Prest-O-Lite Service plan. Write us about it.

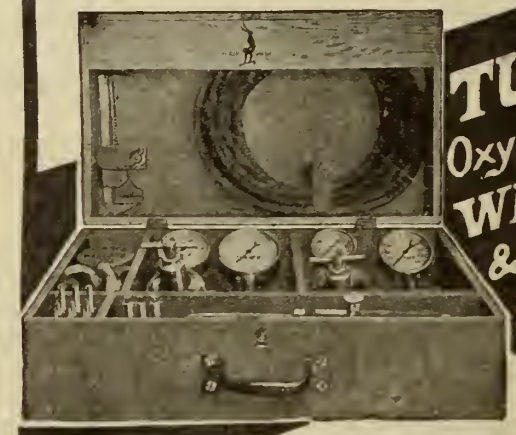
Prest-O-Lite Company of Canada, Limited

Dept. C-107, Prest-O-Lite Bldg., Toronto, Canada

Branches: MONTREAL TORONTO WINNIPEG

Plants at: Toronto, Ont. St. Boniface, Man.
Merritton, Ont. Shawinigan Falls, P.Q.

For Repairing Broken Machinery or Tools of Medium Size



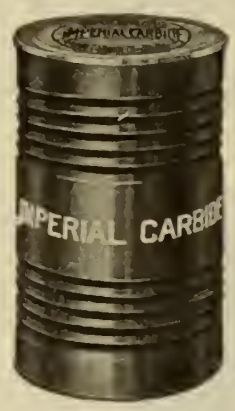
These outfits will soon pay their cost in machine parts or tools reclaimed. The sectional extensions of the torch enable the operator to adjust it to any desired length or angle. The location of valves is such that the flame is controlled by one hand, leaving the other hand free for the work at all times.

For full particulars write

The Turner Brass Works

SYCAMORE, ILLINOIS, U. S. A.

IMPERIAL CARBIDE



For Welding Cutting and Lighting

HIGHEST GAS YIELD
IMPERIAL CARBIDE
MADE IN CANADA

It insures **effectiveness** and **economy** by **invariably** producing acetylene gas of **unusual purity.**

Manufactured by

Union Carbide Co. of Canada, Ltd.

WELLAND, ONTARIO

Large Stocks maintained at convenient distributing centres throughout Canada

Guaranteed Purity Reliable Service

OXYGEN AND ACETYLENE

BLOWPIPES - REGULATORS
FILLING RODS - FLUXES
ACCESSORIES

L'AIR LIQUIDE

8 FACTORIES IN ACTUAL OPERATION AT
HALIFAX-MONTREAL-TORONTO-LONDON-SUDBURY
WINNIPEG-CALGARY-VANCOUVER
Additional Factories in course of Erection



A Few Facts About Liquid Air Service

Liquid Air Service Department is composed of men who are specially selected for their expert practical and technical knowledge of the Oxy-Acetylene Process. They are at the disposal of all our customers to whom their services may be of use for which no charge is made and no obligation incurred.
In addition to our eight factories, five Distribution Stations have been established at St. John's, Nfld.; Sydney, N.S.; Quebec, Que.; Ottawa, Ont., and Windsor, Ont., respectively, for an immediate supply of Oxygen and Acetylene to consumers located in these Districts, with a minimum of freight rates and the elimination of delays occasioned by long distance haulage.
At the present time as in the past, L'Air Liquide is in a position to give service which is unassailable.



C.W. **PRICE LIST** C.W.

Oxy-Acetylene and Electric Welding Supplies

C.W. Atlas Cast Iron Welding Sticks

3/16 x 12 inches, per lb.	$0.25
¼ x 19 inches, per lb.	.23
⅜ x 19 inches, per lb.	.18
½ x 20 inches, per lb.	17½

C.W. Norway Imported Welding Rods, for Wrought Iron and Steel

3/16 x 36 inches, per lb.	$0.23
¼ x 36 inches, per lb.	.22

C.W. Imported Special Welding Rods, for Wrought Iron and Steel

1/16 x 36 inches, per lb.	$0.22
3/32 x 36 inches, per lb.	.22
⅛ x 36 inches, per lb.	.23
3/16 x 36 inches, per lb.	.22
¼ x 36 inches, per lb.	.20

C.W. Nickel Steel Welding Rods, for Alloy Steels

⅛ x 36 inches, per lb.	$0.34
3/16 x 36 inches, per lb.	.32
¼ x 36 inches, per lb.	.30

C.W. Vanadium Steel Welding Rods, for Alloy Steels

¼ x 36 inches, per lb.	$0.32

C.W. Cast Aluminum Welding Rods

3/16 x 12 inches, per lb.	$1.25
¼ x 12 inches, per lb.	.98
5/16 x 12 inches, per lb.	.88

C.W. Welding Sticks, for Brass and Bronze

5/32 x 12 inches, per lb.	$0.80
¼ x 12 inches, per lb.	.70
⅜ x 12 inches, per lb.	.64

C.W. Brazier Wire, for Brazing

⅛ x 36 inches, per lb.	$0.50
¼ x 36 inches, per lb.	.50

C.W. Special Welding Rods, for Malleable Iron

⅛ x 36 inches, per lb.	$0.67
3/16 x 36 inches, per lb.	.75

C.W. Special Wire, for Copper

⅛ x 36 inches, per lb.	$0.55
¼ x 36 inches, per lb.	.54

FLUX

C.W. Scaling Powder, for Cast Iron

1-lb., 2-lb., and 5-lb. cans, per lb.	$0.25

C.W. Flux Powder, for Brass, Bronze, Copper

1-lb. and 2-lb. cans, per lb.	$0.40

C.W. Carbonite Blocks and Rods

⅜ x 24 inches, per rod	$0.45
½ x 24 inches, per rod	.35
⅝ x 24 inches, per rod	.45
¾ x 24 inches, per rod	.60
⅞ x 24 inches, per rod	.80
1 x 24 inches, per rod	.90
¾ x 5 x 18 inches, per block	2.50
½ x 6 x 24 inches, per block	3.00
1 x 6 x 30 inches, per block	4.50

Goggles, Welding

C.W. Goggles, per pair (in green)	$2.00
Extra Colored Lenses, per pair	.50
C.W. Goggles, per pair (in amber)	2.00
Extra Colored Lenses, per pair	.50
Riveters' Goggles	2.50
Chippers' Goggles	2.50
Grinders' Goggles	2.50

Welding and Cutting Gloves

Gauntlet Gloves, per pair	$1.50
Welders' Gauntlet Gloves, per pair	2.00
Fireproof Asbestos Cloth Gloves, per pair	6.00

Welding and Cutting Hose

H.P. Corrugated, for oxygen, per foot	$0.30
Black Corrugated, for oxygen, per foot	.30
Red Corrugated, for Acetylene, per foot	.30
Coppered Armored, for oxygen or acetylene	.45
H.P., for oxygen, per foot	.45
Fabric Covered, for oxygen, per foot	.17

Electric Welding

Electric Welding Wire, per lb.	$0.17
Electric Welders' Goggles and Face Mask	15.00
Pre-heating Burners	$15.00 to 75.00
Blacksmiths' Fluxes, per lb.	.15
Asbestos Sheet Paper, per lb.	.17
Valves for oxygen tanks	2.75

The Carter Welding Company of Toronto, Limited

Canadian Distributors for the famous "Rego" Non-flash Welding and Cutting Apparatus

Office, Works and Demonstration Plant

9-11 SHEPPARD ST. - - TORONTO, ONT.

Telephones
Ad. 1524 Ad. 2841

Nights and Sundays
Hill. 5101 Bel. 1789

AGENTS:

Compressed Gas Co., Vancouver, B.C.; Staines-Williams, Calgary, Alta.; A. R. Williams Machinery Co., and Toronto Welding Company, Toronto, Ont.; T. D. Sutherland, Niagara Falls, Ont.; People's Gas Company, Ottawa, Ont.; W. Carter Co., Hamilton.

"In the Smugglers' Den"

An Intimate and Dramatic Story of Boot-leggers and the Activities of Rev. J. O. L. Spracklin of the Border Cities.

MR. CHARLES CHRISTOPHER JENKINS, the writer of this story, arrived in Windsor a few hours before Trumble was shot by the Rev. J. O. L. Spracklin; and during the next few days among the experiences which befell MacLean's Magazine special representative was one of particularly dramatic and timely interest —a few hours spent within the lair of one of the smugglers' "Master Minds."

This graphic story from Mr. Jenkins' pen will enable you to get a real grip of what this all means, particularly from the side of those who are beyond the pale of the law.

The story is illustrated by some exclusive and timely photographs showing the chief actors and various resorts within the sphere of their activities.

December 1st Issue of MACLEAN'S Brimful of Fascinating Reading

"AUTOBIOGRAPHY OF MRS. ASQUITH"
Wife of the former Prime Minister of Great Britain.
One of the strongest and most interesting stories Mrs. Asquith tells in her extraordinary reminiscences.

"THE CITY OF PERIL"
By Arthur Stringer.
Four more pages of this gripping, enthralling, melodramatic story of Bolshevistic adventure in New York.

"JEFF HEARS THE CALL"
By C. W. Stephens.
The story of a fight with forest fire, of rescue by the air route from a horrible death by flames.

"LINKING TWO INLAND SEAS"
By J. L. Rutledge.
Here you have the account of the struggles which led to the construction of one of Canada's greatest transportation links.

"THE TEST"
By Harry C. Douglas.
This is a charming little short story with a surprising conclusion.

"THE DRAMA OF OUR GREAT FORESTS"
By Arthur Heming.
The second instalment of this gripping serial is entitled "Oo-Koo-Hoo's Eldorado." On the cover will be another Heming picture.

"FLIRTING WITH OUIJA"
By Col. George H. Ham.
The genial George's adventures in the mystic, with necromancers and hypnotists.

"LEAVES OF KACHUBOONG"
By Madge Macbeth.
An intriguing detective story by the well-known Canadian authoress, who has specialized in depicting criminal types.

"FIRST ROW, ORCHESTRA"
By Leslie G. Barnard.
In this you have the catchy story of a small town girl who became a big town actress.

"OUR GOLDEN FLOOD ROARS EAST"
By Nicholas North.
The story of how our grain is graded; the difficulties in marketing 275,000,000 bushels of wheat.

Review of Reviews

Some of the subjects treated in our reviews in December 1st issue include :

Fiume under D'Annunzio.
The War Spirit in the World—Sisley Huddleston.
Russia in the Shadow—H. G. Wells.
Benedict XV, Royal Diplomat.
The Irresistible Thing—Sir Gilbert Parker.
The Russian Intelligence—Leo Pasvolsky.
Simple Solution of the Labor Problem.
Letting the Prisoners Govern Themselves—Frank Tannenbaum.
German Universities Hard Up—Allen W. Porterfield.
The New Search for Oldest Man—Roy C. Andrews.

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Over 80,000 Canadian Families Buy

MACLEAN'S

"CANADA'S NATIONAL MAGAZINE"

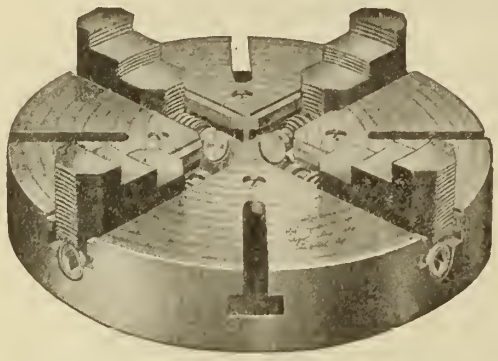
DECEMBER 1st ISSUE *On All News-stands* ***20c***

Or Send $3.00 for a Year's Subscription to MACLEAN'S MAGAZINE, 143-153 University Avenue, Toronto, Canada

ALL STEEL

INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



THE UNION STEEL BODY CHUCKS are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

UNION MANUFACTURING COMPANY

New Britain, Conn.

New York Office: 26 Cortlandt Street

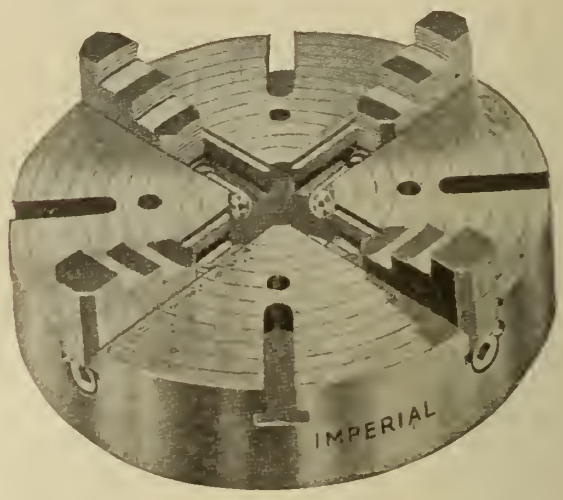
Makers of a complete line of chucks

IMPERIAL LATHE CHUCKS

Highly Endorsed by Canada's Best Manufacturers

Sturdy long-wearing "Made-in-Canada" Chucks that are making good everywhere.

Specify them in your next order.

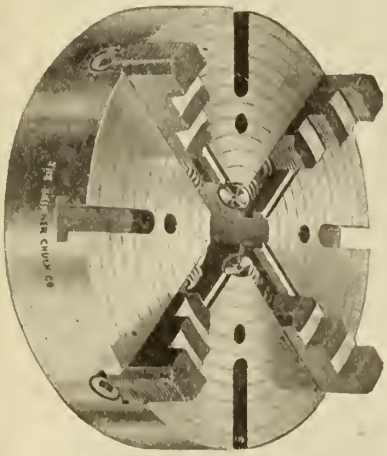


Ker & Goodwin Machinery Co.

BRANTFORD, Ont. LIMITED

Strong Chucks—

That truly describes Skinner Steel Body Independent Lathe Chucks. They are not only strong and powerful, but wonderfully accurate. The



4-Jaw Independent Chuck, Steel Body, for Heavy Duty

SKINNER Steel Body Independent Lathe Chuck

is a single steel casting of great strength, well proportioned and accurately finished. Face is graduated accurately in inches. Screws and bearings are made of the toughest steel to withstand abnormally hard wear.

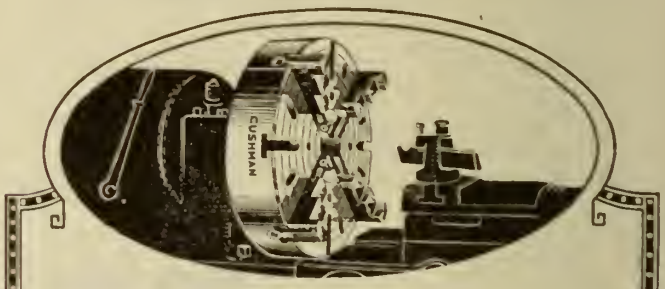
The dependability of Skinner Steel Body Independent Lathe Chucks is conclusively proved by the fact that not one has ever been known to break in service—and we have been making them for many years.

Write for catalogue and illustrated literature.

THE SKINNER CHUCK COMPANY

NEW BRITAIN, CONN U S A

ESTABLISHED 1887



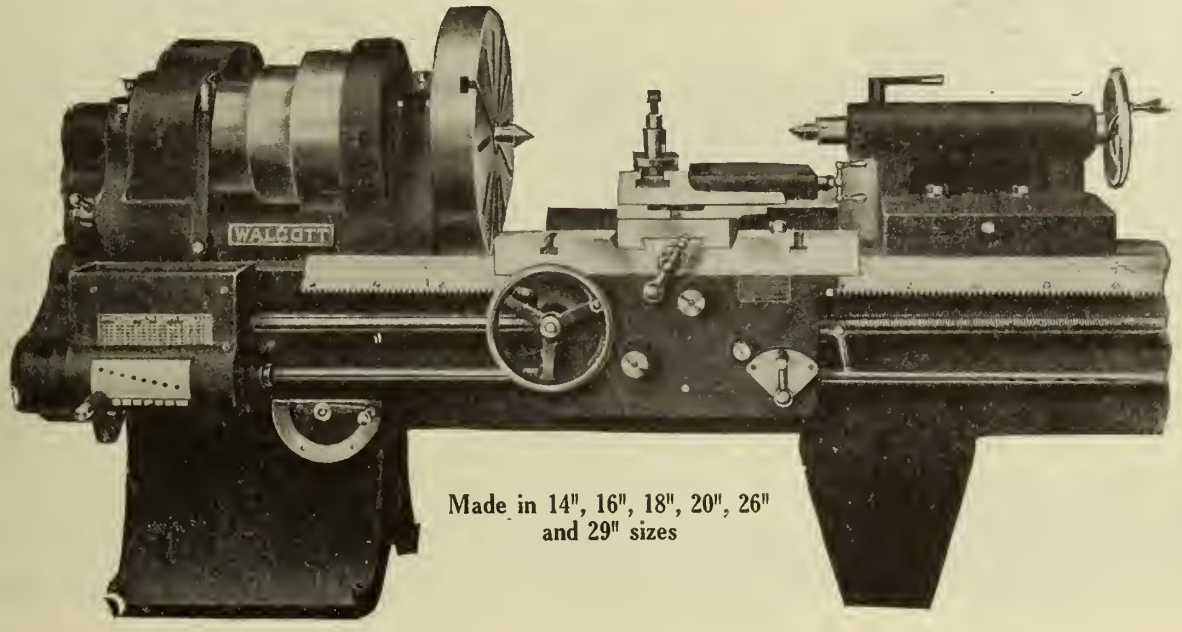
FOR THE BUSINESS END OF YOUR LATHES

"CUSHMAN" CHUCKS 1862

ARE YOU GETTING THE DRIVING POWER OUT OF YOUR MACHINES WHICH THEY ARE RATED TO PULL? EQUIPPING YOUR MACHINES WITH CUSHMAN CHUCKS IS A BUSINESS PROPOSITION. THEY WILL DELIVER MAXIMUM POWER---THEY WILL SATISFY AND PLEASE THE MOST EXACTING WORKMAN.

THE CUSHMAN CHUCK CO. HARTFORD, CONN., U.S.A.

WALCOTT



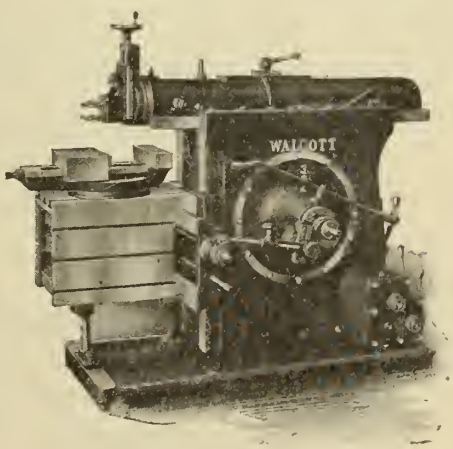
Made in 14", 16", 18", 20", 26" and 29" sizes

A Lathe With a Good Name

When you purchase an engine lathe you naturally turn to one with an established reputation. The **Walcott** has been in the field for 39 years. It is regarded by practical and experienced machinists as a lathe that can be depended upon for **quality** and **quantity** production. The simplicity of its design, strength of construction, high quality of material and finish appeal to the man in shop; he can do his best work on the Walcott. Distinctive features are double plate apron, drop forge gears in apron, rigid compound rest, back gears reinforced by one-piece gear guard and headstock, feed gears running in oil, extremely deep bed, large front way on bed and feed rod and screw directly under front way.

Investigate This Walcott Before Buying Your Next Shaper

Every detail in the construction of this **Walcott** Crank Shaper represents the best efforts of the **Walcott** engineering staff to produce a machine that will turn out work accurately and fast. Have us send you a full description.



WALCOTT LATHE CO.

115 Calhoun St., Jackson, Mich.

Canadian Agents: The Canadian Fairbanks-Morse Co., Ltd., Montreal, Toronto, Ottawa, St. John, N.B.; Winnipeg, Calgary, Saskatoon, Vancouver, Victoria.

If interested tear out this page and place with letters to be answered.



Name of Hardware Merchant and further details, supplied upon request

The Answer is—He Didn't!

THE crowd was drawn by a hardware firm in an Ontario town of 700 population. This crowd of over 1,000 people represents customers of the store, drawn from miles around, to attend the picnic given by this firm to its customers. Surely this is evidence of the close relationship between this hardware firm and its customers.

The close relationship between retailer and customer in this instance is typical of conditions existing in hundreds of Canadian towns, villages and cities.

The average hardware merchant (particularly in the smaller cities and towns) has been established for many years. He has a big business connection built up through years of efficient service to his customers. He is well rated, and a desirable man with whom to do business. He influences the buying habits of the people in his community, and in over 90% of the sales made, he is the deciding factor.

"Which one do you recommend?" is a question asked thousands of times each day in the hardware stores of Canada.

If you can get the effort and enthusiasm of the retail hardware merchants and their clerks, plus their window and interior displays and local advertising behind your goods, you will have secured the co-operation of one of the greatest available selling forces.

HARDWARE AND METAL is paid for, and read, by all the wholesale hardware buyers of Canada, and over 90% of the retailers from coast to coast. They are the men who control the sale of your products to the hardware consumers. HARDWARE AND METAL can put your story before, practically, the entire Canadian hardware trade. One of our representatives would be glad to give further details.

(Only hardware paper in Canada with membership in the Audit Bureau of Circulations).

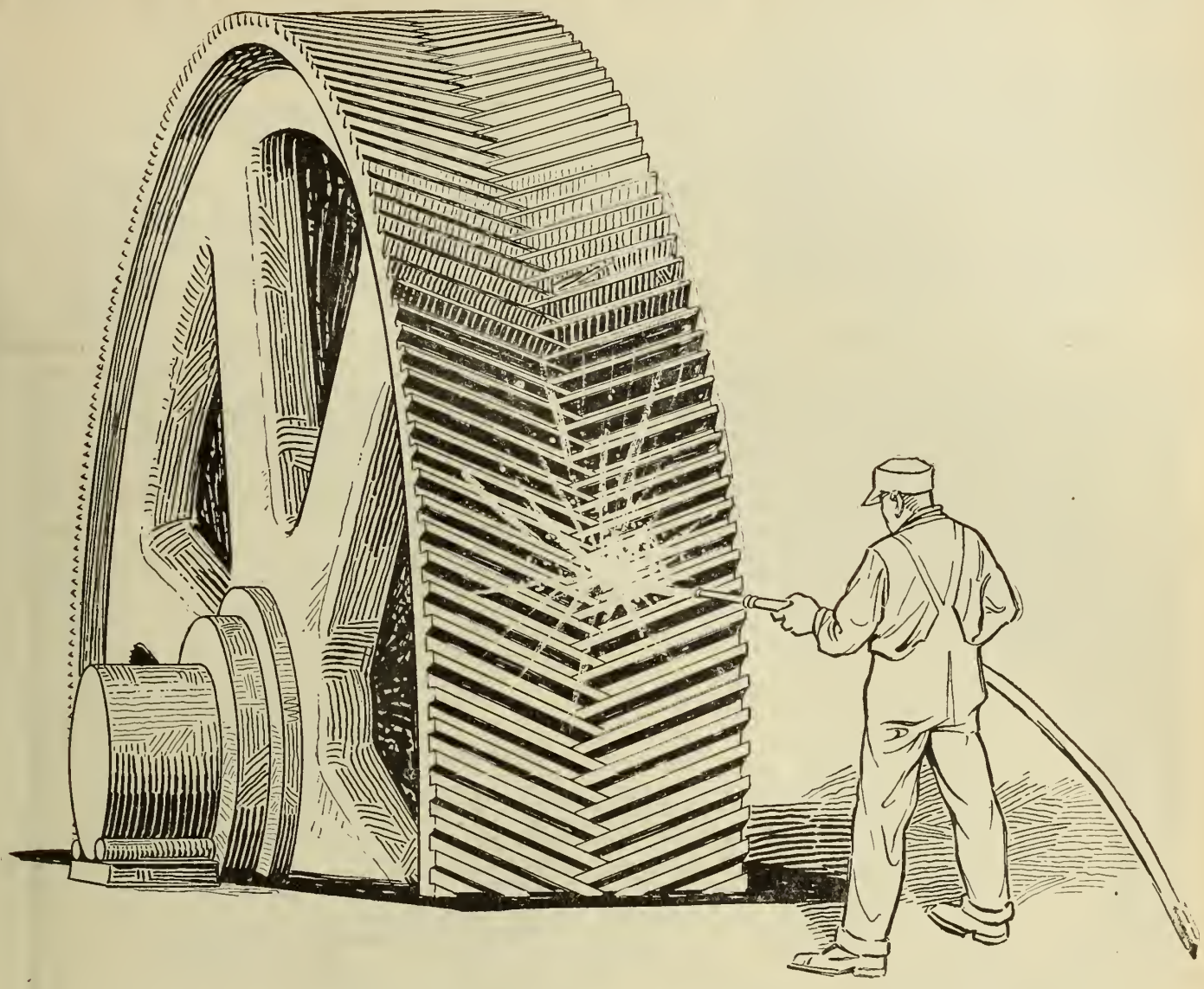
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Canada's National Hardware Weekly since 1888

143-153 University Avenue - - Toronto, Canada

Published every Saturday since 1888. The only weekly hardware paper in Canada, and the only hardware paper in Canada that gives you a circulation statement audited by the Audit Bureau of Circulations

Montreal Branch, Southam Building **Winnipeg Branch, Union Trust Building**



Oakite Cleans 16 Times Faster

ONE MAN, with Oakite cleaning methods and materials, cleans one of these big gears thoroughly and satisfactorily in an hour.

The large reduction gears made in this turbine plant measure up to 30 feet in diameter and weigh up to *twenty tons* each.

Formerly *two men* using kerosene required two whole days to remove the ground glass or silica and mineral oil left by the grinding operation on the teeth.

Oakite materials enable one man to do as much cleaning in one hour as two men did in 16 hours. Oakite cleans 16 times faster — thereby saving much time and labor.

This advertisement is one of a series based on actual occurrences.

May We Serve YOU Too?

OAKITE MANUFACTURED BY
OAKLEY CHEMICAL CO.
44 THAMES STREET · NEW YORK

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Rotary Continuous Heat-Treating Furnaces
Used in Quantity Production of Pressed Steel Parts

METALLURGISTS

The following advantages are secured by the Continuous Method of Heat-Treatment:

Bringing material up gradually to the final temperature.
Utilizing heat in spent gases to preheat material.
Exposing each piece to heat in same manner, to same temperature, for same length of time.
Uniformity not only of the individual piece but of the sections thereof as compared with the corresponding sections of other pieces.

DO THESE ADVANTAGES APPEAL TO YOU?

Write for Bulletin 217-T and learn whether the continuous method is adaptable to your product and manufacturing conditions.

W. S. ROCKWELL COMPANY
Furnace Engineers and Contractors
50 Church St. (Hudson Terminal Bldg.) New York
We make Industrial Heating Furnaces for Every Requirement.
"FURNACE AND FUEL TO SUIT CONDITIONS."

Address Canadian Representative:
R. J. McLEAN, 604 Southam Bldg., MONTREAL, P.Q.

W. S. ROCKWELL CO. INDUSTRIAL ESTABLISHED 1888 FURNACES 50 CHURCH ST. NEW YORK

TRAHERN PUMPS

FOR
CUTTING TOOL LUBRICATION

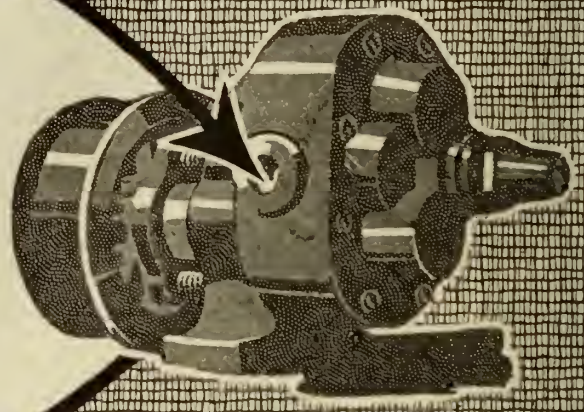
Trahern Pumps are used by the leading manufacturers of Metal Working Machinery.

Powerful at low speed, they will operate in either direction, and supply a generous, steady flow into the deepest cuts and bores.

They will not lose their prime when properly installed. If desired will operate against 100 lbs. pressure.

You will find Trahern Pumps efficient, reliable, and economical.

Delivery from stock. Prices low. Our catalog No. 44 will explain in detail.



TRAHERN PUMP DIV. Geo. D. Roper Corp. Rockford, Ill.

DIAMONDS
For Truing Grinding Wheels



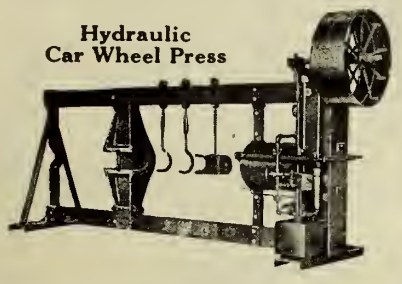
A new and large assortment of the finest diamonds for dressing emery wheels has been added to our stock. Canadian manufacturers will do well to let us know their requirements.

Canadian Desmond-Stephan Mfg. Co., Limited
Hamilton, Ontario, Canada

LOURIE HYDRAULIC PRESSES

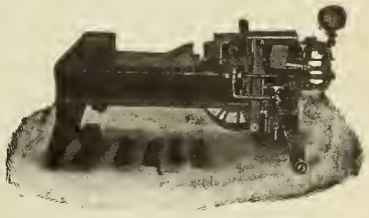
For Every Purpose Requiring Pressure

Hydraulic Car Wheel Press



We manufacture a complete line of presses for bending, straightening, forcing, forming, broaching, welding, baling, and many other purposes.

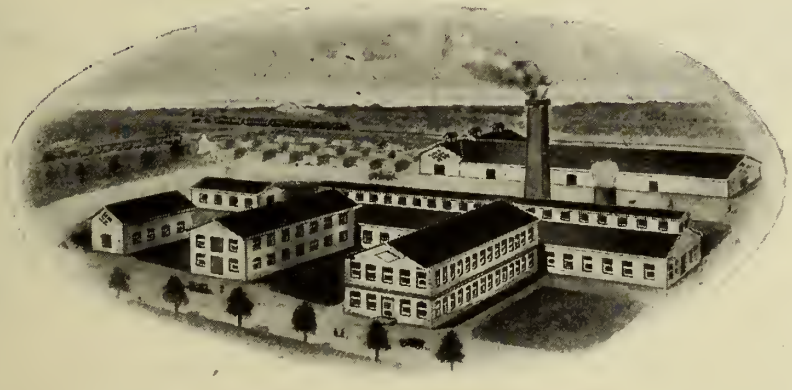
Hydraulic Bulldozer



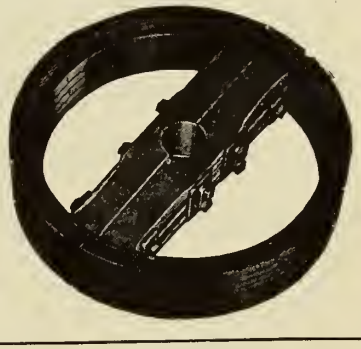
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LOURIE MANUFACTURING CO.
SPRINGFIELD, ILLINOIS, U.S.A.

"BERNARD" TRANSMISSION APPLIANCES



have achieved an enviable reputation in the Industrial World. Their performance under every conceivable working test has proved their dependability, and they are the most economical because of their durability.
We stand back of our products and will give Dealers every assistance.
Put them to the test.



The A. Bernard Industrial Co.

Manufacturers of High-Grade Power Transmission Appliances
Offices and Works: FORTIERVILLE, Que., Canada

The HEPBURN Scotch Derrick

A simple piece of equipment that has been proved to be of immense value in the handling of heavy material. A valuable labor and time-saving addition to the hoisting equipment of the foundry or yard. Indispensable in the handling of heavy castings and machinery, loading and unloading, construction work, etc. Repair parts always carried in stock. Standard price list on request.

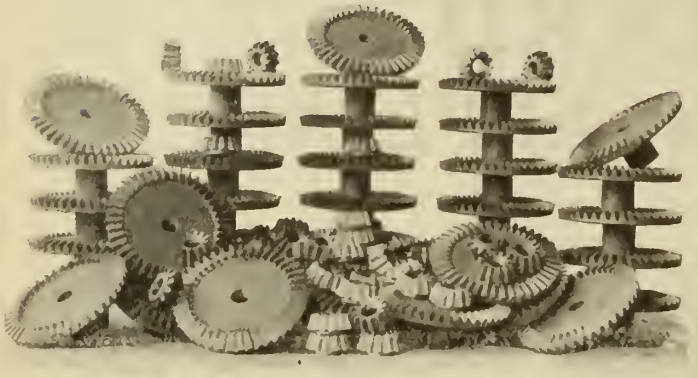


John T. Hepburn Limited, 16-60 Van Horne St., Toronto

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Gears in Quantities



On large production orders we can give you special service. Our facilities count there.

Hamilton Gear & Machine Co.

Van Horne St. - - TORONTO



PERRIN
400-Ton Hydraulic Wheel Press

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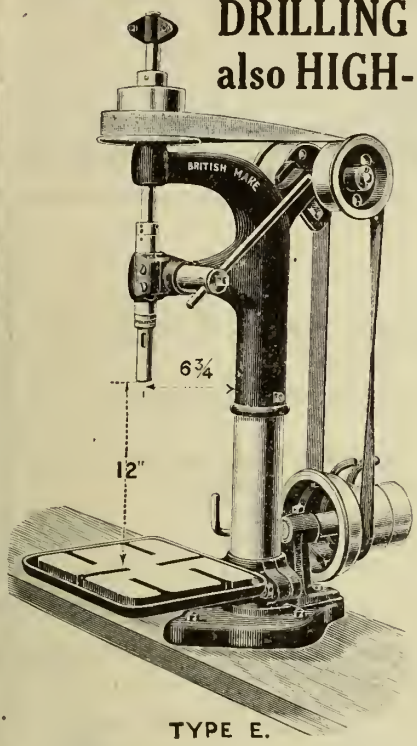
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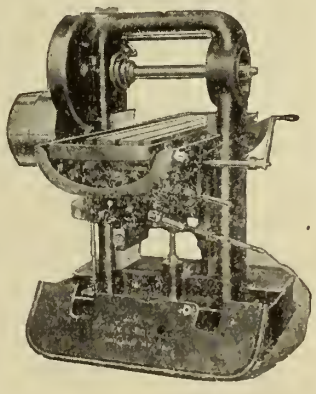
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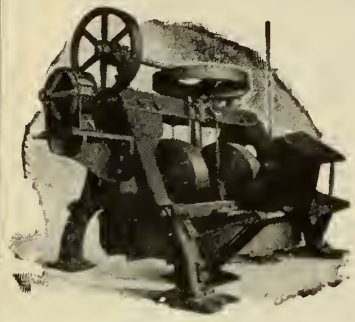
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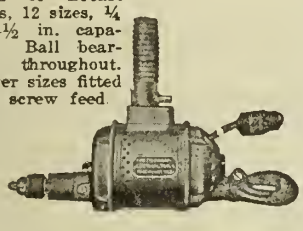
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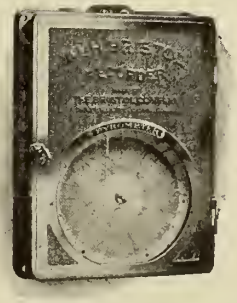
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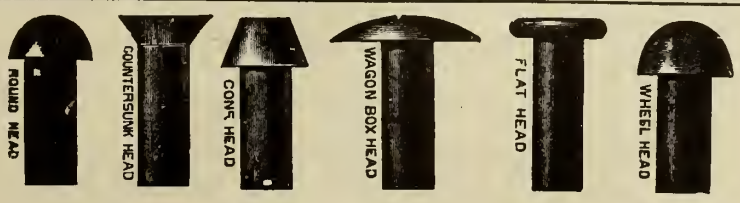
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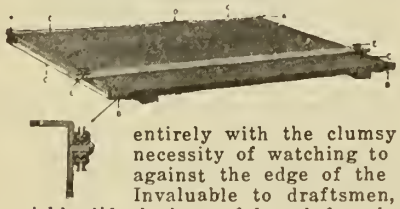
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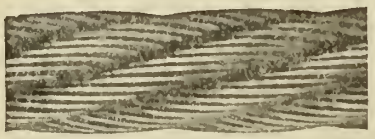
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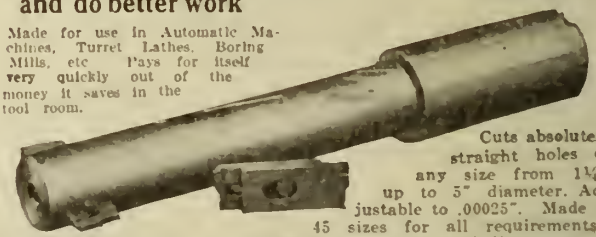
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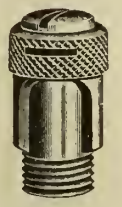
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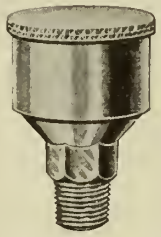
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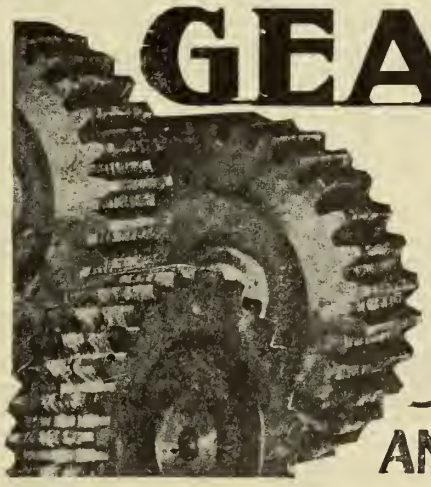
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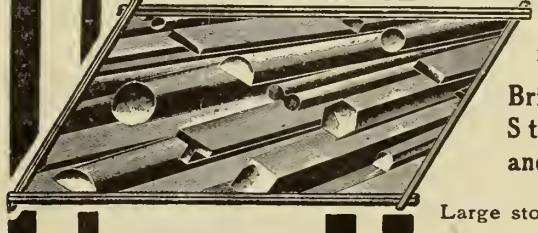
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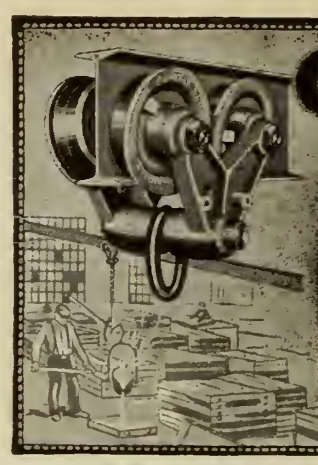
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Aikenhead Hardware Co., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Canada Metal Co., Toronto.
G. F. Foss Mchy. & Sply. Co., Montreal.

AUXILIARY HEADS
Hoefer Mfg. Co., Freeport, Ill.

BABBITT METAL
British Smelting & Refining Co., Ltd., Montreal.
Canada Metal Co., Toronto.
Furniss, Clarke & Co., Montreal, Que.
G. F. Foss Mchy. & Sply. Co., Montreal.
Hoyt Metal Co., Ltd., Toronto.
Magnolia Metal Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

BAND SAWS
Atkins & Co., E. C., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

BALL BEARINGS
Canadian Fairbanks-Morse Co., Montreal
Can. S. K. F. Co., Toronto, Ont.
Chapman Double Ball Bearing Company, Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., John, Ingersoll
Williams Mchy Co., A. R., Toronto, Ont.

BALLS, STEEL
Atkins & Co., Wm., Sheffield, Eng.
Chapman Double Ball Bearing Company, Toronto.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Marshall Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BAROMETERS
Taylor Instrument Co., Rochester, N.Y.

BARRELS, STEEL SHOP
Baird Machine Co., Bridgeport, Conn.
Cleveland Wire Spring Co., Cleveland.

BARRELS, TUMBLING
Baird Machine Co., Bridgeport, Conn.
Katie Foundry, Galt, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.

BARS, BORING
Gisholt Machine Co., Madison, Wis.
Madison Mfg. Co., Madison, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams & Co., J. H., Brooklyn, N.Y.

BARS, CONCRETE REINFORCING
Algoma Steel Corp., Sault Ste. Marie.

BARS, MERCHANT
Algoma Steel Corp., Sault Ste. Marie.
Peckovers, Ltd., Toronto, Ont.
United Alloys Steel Corporation, Canton, Ohio.

BASE FACING MACHINES
Victoria Foundry Co., Ottawa, Ont.

BATTERIES
Northern Electric Co., Ltd., Montreal, Que

BELT CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sumner & Co., New York, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

BEARINGS, GRAPHITE BRONZE
Lyman Tube & Supply Co., Montreal, Que.

BEARINGS, ROLLER
Lyman Tube & Supply Co., Montreal, Que.

BELT-LACING MACHINES, HOOKS AND PINS
Clipper Belt Lacer Co., Grand Rapids.

BELT LACING LEATHER
Aikenhead Hardware Co., Toronto, Ont.
G. F. Foss Mchy. & Sply. Co., Montreal.
Graton & Knight Mfg., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

BELTING, BALATA
Federal Engineering Co., Toronto, Ont.

BELT HOOKS, WIRE
Clipper Belt Lacer Co., Grand Rapids.

BELTING, RUBBER
Can. Consolidated Rubber Co., Montreal.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber Ltd., Toronto, Canada.

BELTING, CHAIN
Canadian Fairbanks-Morse Co., Montreal
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Renold of Canada, Ltd., Montreal.
Whitney Mfg. Co., Hartford, Conn.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, CONVEYOR
Can. Consolidated Rubber Co., Montreal.
Can. Link-Belt Co., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Federal Engineering Co., Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Graton & Knight Mfg., Worcesteh, Mass.
International Mchy. Spls., Ltd., Montreal
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McLaren Belting Co., J. C., Montreal.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co., Philadelphia, Pa.
Rice, Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Sumner & Co., New York, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, FRICTION AND SURFACE
Can. Con. Rubber Co., Ltd., Montreal.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, HAIR
Sumner & Co., New York, N.Y.

BELTING, LEATHER
Can. Graton & Knight Mfg. Co., Montreal
Gutta Percha & Rubber, Ltd., Toronto, Canada.

BELTING, RUBBER
International Mchy. Spls. Ltd., Montreal.
Quaker City Rubber Co., Philadelphia, Pa.

BELTING, STITCHED COTTON DUCK
Dominion Belting Co., Hamilton, Ont.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, WOVEN
Federal Engineering Co., Ltd., Toronto.
Sumner & Co., New York, N.Y.

BENDING MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.
Bertarm & Sons Co., John, Dundas.
Brown-Boggs Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Kitchener.
Dom. Steel Product Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BLAST GATES
W. S. Rockwell Co., New York, N.Y.

BLASTING MACHINES, SAND
Garlock-Walker Machinery Co., Toronto.
Jardine, A. B., & Co., Hespeler, Ont.
National Mach. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Toledo Machine & Tool Co., Toledo.
Williams Mchy Co., A. R., Toronto, Ont.

BILLETS
Atkins & Co., Wm., Sheffield, Eng.
Swedish Steel & Importing Co., Ltd., Montreal.
Algoma Steel Corp., Sault Ste. Marie.
Marshall, Son & Bunney, Toronto.
United Alloy Steel Corp., Canton, Ohio.

BILLETS, FORGING
Dominion Foundries & Steel Ltd., Hamilton, Ont.

BINS, STEEL
Dennis Wire & Iron Works, London, Ont.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que
Toronto Iron Works, Ltd., Toronto, Ont
William Hamilton Co., Peterboro, Ont.

BLACKSMITH WORK
The Thos. Pink Co., Ltd., Pembroke.

BLOCKS, CHAIN
Oliver Engineering Co., Montreal.

BLOOMS AND SLABS
Algoma Steel Corp., Sault Ste. Marie.
United Alloy Steel Corp., Canton, Ohio.

BLOWERS
Can. Blower & Forge Co., Kitchener, Ont.
Garlock-Walker Machinery Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.

BLOWING ENGINES
General Combustion Co., Ltd., Montreal, Que.

BLOW PIPES AND REGULATORS
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.

BLUE PRINTING MACHINERY
Commercial Camera Co., Providence, R.I.

BLUE PRINT PAPER
Hughes, Owens Co., Ltd., Montreal, Que.

BOARTZ
Joyce, Koebel & Co., Inc., New York.

BOILER TUBES
Lyman Tube & Supply Co., Montreal, Que.

BOILER BREECHINGS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
William Hamilton Co., Peterboro, Ont.

BOLT CUTTERS
Fellows Gear Shaper Co., Springfield, Vt.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOILERS, RANGE
Can. John Wood Mfg. Co., Ltd., Toronto.

BOILERS
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.

BOILERMAKERS' TOOLS
Holden & Co., Ltd., Montreal, Que.

BOLT CUTTERS AND NUT TAPERS
Aikenhead Hardware Co., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Landis Machine Co., Waynesboro, Pa.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOLTS
Aikenhead Hardware Co., Toronto, Ont.
London Bolt & Hinge Wks., London, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Rice, Lewis & Son, Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton
Wilkinson & Kompass, Hamilton, Ont.
Williams & Co., J. H., Brooklyn, N.Y

BOLTS, COUPLING
Galt Machine Screw Co., Ltd., Galt, Ont.

BOLTS, STAY
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, SPRING SHAKLE
Can. Winkley Co., Ltd., Windsor, Ont.
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, PATCH
Morrow Screw & Nut Co., John, Ingersoll

BOLT AND NUT MACHINERY
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Mchy Co., A. R., Toronto, Ont.

BOLT THREADING MACHINERY
Jardine & Co., Ltd., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

BONDING MACHINES (Electric Railway)
The Lincoln Electric Co., Toronto, Ont.

BORING MACHINES, PNEUMATIC CYLINDER
Cleveland Pneumatic Tool Co., Toronto.
Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto.

BORING MACHINES, UPRIGHT AND HORIZONTAL
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Herbert, Ltd., Alfred, Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Hoefer Mfg. Co., Freesport, Ill.
Landis Tool Co., Waynesboro, Pa.
Oliver Machinery Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Rockford Drilling Mche. Co., Rockford, Ill.
Strelinger Chas. A. Co., Windsor, Ont.

BORING AND TURNING MILLS
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Foss Mch. & S'ply Co., Geo. F., Montreal
Herbert, Ltd., Alfred, Toronto, Ont.
Oliver Mach. Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.
Strelinger Chas. A. Co., Windsor, Ont.

BOXES, CAST IRON
Brown & Sharpe Mfg. Co., Providence, R.I.

BOXES, STEEL SHOP AND TOTE
Cleveland Wire Spring Co., Cleveland.

BARKES
Brown, Boggs & Co., Hamilton, Can.
Electric Steel & Metals, Ltd., Welland.

BRASS—SHEETS, ROLLS, PLATES, AND RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRASS ALLOYS
British Smelting & Refining Co., Ltd., Montreal, Que.

BRASS AND COPPER TUBING
Lyman Tube & Supply Co., Montreal, Que.

BRASS FOUNDERS
Canada Metal Co., Toronto.
Tallman Brass & Metal Co., Hamilton.

BRASS GOODS
Crane, Ltd., Montreal, Que.

BRASS PIPE AND TUBE
Crane, Ltd., Montreal, Que.

BRASS WORKING MACHINERY
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machinery Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Prest-O-Lite Co., Inc., Toronto, Ont.
Wool Turret Machine Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.
Brown's Copper and Brass Rolling Mills, New Toronto.

BRICKS, FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

BRIDGES, RLY. AND HIGHWAY
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

BROACHING MACHINES
Strelinger, Chas. A. Co., Windsor, Ont.

BRONZE—SHEETS, ROLLS, PLATES AND RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRONZE, NAVAL
Canada Metal Co., Toronto.

BRONZE COPPER
Tallman Brass and Metal Co., Hamilton.
Canada Metal Co., Toronto.

BRUSHES, CARBON
Lyman Tube & Supply Co., Montreal, Que.

BUFFING AND POLISHING MACHINERY
Ford-Smith Mach. Co., Hamilton.
Foss Mchy. & S'ply Co, Geo. F., Montreal
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BUCKETS, DUMP
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

BUCKETS, ELEVATOR
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

BUCKETS, CLAM SHELL, CRAB, DUMP
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd., Walkerville.

BULLDOZERS
Bertram & Sons Co., John, Dundas.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford
Garlock-Walker Machinery Co., Toronto.
Lourie Mfg. Co., Springfield, Ill.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

BURNERS, OIL AND NATURAL GAS
Northern Crane Works, Ltd., Walkerville.
W. S. Rockwell Co., New York, N.Y.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque.

BUSHING, BRONZE
Morrow Screw & Nut Co., John, Ingersoll

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CABLES, TRANSMISSION AND TELEPHONES
Northern Electric Co., Ltd., Montreal.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Carter Welding Co., Ltd., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Union Carbide Co., of Canada, Limited, Weland, Ont.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville.
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co., Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glasco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

CAR MOVERS
Holden Co., Ltd., Montreal, Que.

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Can. Metal Co., Toronto, Ont.

CASTINGS, DIE CAST
Can. Metal Co., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.
Fisher Motor Co., Ltd., Orilla, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

CASTINGS, STEEL—ALL KINDS
Canada Electric Castings, Ltd., Orilla, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co., Ltd., Orilla, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.

CARRIERS COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll.
Alexander Fleck Ltd., Ottawa.
Tallman Brass & Metal Co., Hamilton

CASTINGS, BENCH LEG
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt, Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown, Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co., Ltd., Orilla, Ont.
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
Interantional Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.
McFarlane Engineering Ltd., G. W., Paris, Ont.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd., Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Morrow Screw & Nut Co., J., Ingersoll.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machinery Co., Toronto.
Lyman Tube & Supply Co., Montreal, Q.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.
Renold of Canada, Ltd., Montreal.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Renold of Canada, Ltd., Montreal.
Williams Mchy. Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Can. Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N. Y.
Glasgow, N.S.
Renold of Canada, Ltd., Montreal.

CHAINS, SPROCKET WHEEL
Can. Link Belt Co., Ltd., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Ltd., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Labatory, Ltd., Toronto.

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, COLLET, AIR
Petrie, Ltd., H. W., Toronto.
Williams Mchy. Co., A. R., Toronto.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn
Dom. Steel Products Co., Ltd., Brantford
Foss Mchy. & S'ply Co., Montreal.
Gardner, Robt. & Son, Montreal.
Garlock-Walker Machinery Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Herbert, Ltd., Alfred, Toronto, Ont.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co. Ltd., Brantford, Ont.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Strelinger, Chas. A Co., Windsor, Ont.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Warner & Swasey Co., Cleveland, O.
Williams Mchy. Co., A. R., Toronto, Ont.

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAY FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York, N.Y.

CLOCK SPRINGS
The Dunbar Brothers Co., Bristol, Conn

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.

CLOSETS
Crane, Ltd., Montreal, Que

CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

COAL CRUSHERS
Can. Link-Belt Co., Ltd., Toronto, Ont.

COAL HANDLING MACHINERY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Nova Scotia Steel & Coal Co., New

COLD ROLLED STRIP, ALL METAL COLLARS, SHAFTING
Can. Driver-Harris Co., Ltd., Walkerville.
Williams & Co., J. H., Brooklyn, N.Y.

COLLECTORS, PNEUMATIC
Can. Blower & Forge Co., Kitchener
Sturtevant Co., B. F., Galt, Ont.

COMPOSITION INGOT
Canada Metal Co., Toronto.

COMPOUNDS, CUTTING AND GRINDING, DRAWING STAMPING
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR
Atkins & Co., E. C., Hamilton, Ont.
Can. Ingersoll-Rand Co., Sherbrooke.
Cleveland Pneumatic Tool Co., Toronto
Curtis Pneumatic Machy. Co., St. Louis
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Superior Machinery Co., London, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CONDENSERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
MacGovern & Co., Montreal, Que.

CONDUITS
Northern Electric Co., Ltd., Montreal, Que.

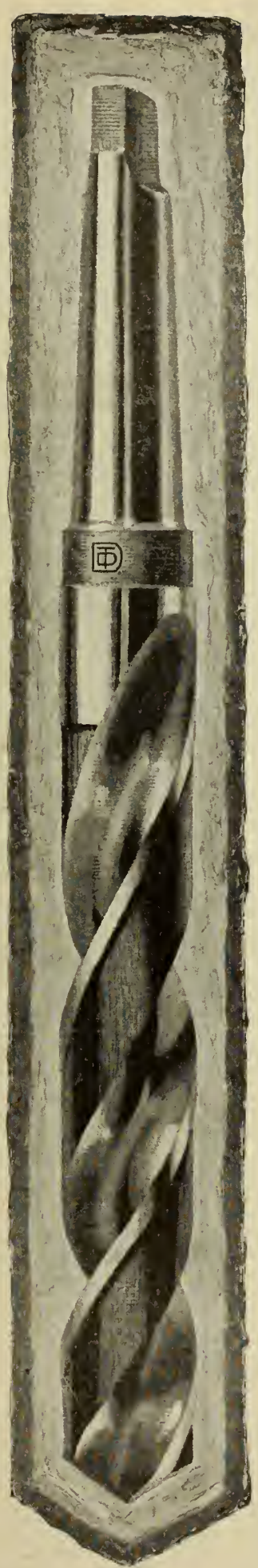
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Canada Found's & Forgings, Ltd., Welland, Ont.

CONNECTING ROD CUTTERS INTERCHANGEABLE
Eclipse Counter bore Co., Ltd., Walkerville, Ont.

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Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.

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Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Can. Blower & Forge Co., Kitchener.

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Cleveland Twist Drill Co., Cleveland.
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Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.

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Eclipse Counterbore Co., Ltd., Walkerville, Ont.

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Almond Mfg. Co., Ashburnham, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Baird Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., Ltd., A. R., Montreal
Williams Mchy Co., A. R., Toronto.

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Can. Link-Belt Co., Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto.

COUPLINGS, RAPID HOSE
Ont. Machinery & Supply Co., Ltd., Montreal, Que.

COILING MACHINERY, WIRE AND SPRING
Garlock-Walker Machinery Co., Toronto.

BUCKET
Hanna & Co., M. A., Cleveland, O.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
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COVERS, OIL HOLE
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CRANES, JIB
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CRANES, LOCOMOTIVE
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Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
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Dominion Bridge Co., Montreal.
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MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
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Oliver Engineering Co., Montreal.

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Williams & Co., J. H., Brooklyn, N.Y.

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CRUSHERS
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Elec. Steel & Metals, Welland, Ont.

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Northern Crane Works, Walkerville.

CURB PUMPS FOR OIL, GASOLINE
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CUTTERS, GEARS
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Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto

CUTTER HEADS
Oliver Machinery Co., Grand Rapids, Mich.

CUTTERS, PIPE (See Pipe Cutters)

CUTTERS, HIGH SPEED
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Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Sply. Co., G. E., Montreal.
Garvin Machine Co., New York.
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Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
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Whitney Mfg. Co., Hartford, Conn.
Wilt Twist Drill Co., Walkerville, Ont

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Cleveland Milling Machine Co., Cleveland

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Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass.
Kennedy & Sons, Wm., Owen Sound
Lyman Tube & Supply Co., Montreal, Que.
Niles-Bement-Pond Co., New York
Prest-O-Lite Co., Inc., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Tabor Mfg Co., Philadelphia, Pa.
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Ford-Smith Machine Co., Hamilton, Ont.
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Petrie Ltd., H. W., Toronto.

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Wheel Trueing Tool Co., Detroit.

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Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
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Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
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National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
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Stoll Co., Inc., D. H., Buffalo, N.Y.
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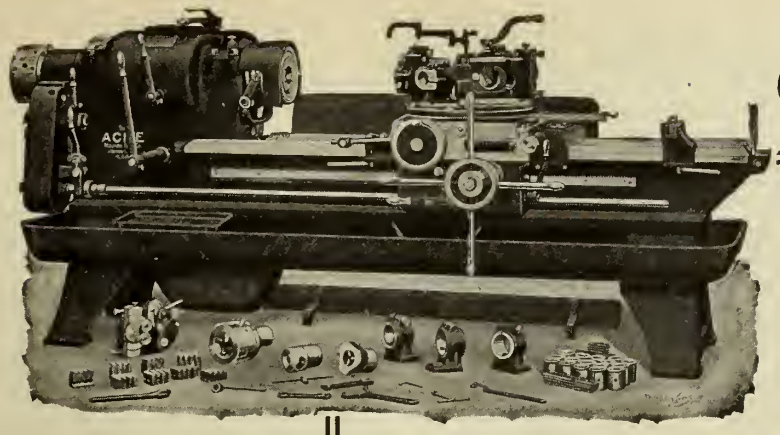
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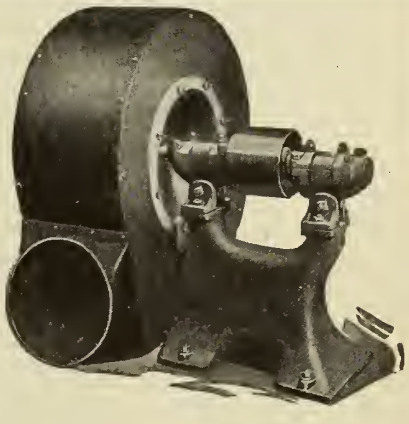
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Strelinger, Chas. A. Co., Windsor, Ont.
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A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Can., Walkerville

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Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
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Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pilot Steel & Tool Co., Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
Strelinger Co., C. A., Windsor, Ont.
U. S. Electrical Tool Co., Cincinnati, O
A. R. Williams Mach. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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DRILLS, EMERY

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Canadian Fairbanks-Morse Co., Montreal
H. A. Drury Co., Montreal.
Geo. F. Foss Mch. & S'ply Co. Montreal
Herbert, Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
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Morse Twist Drill & Machine Co., New Bedford, Mass.
Osborne, Samuel, Montreal, P.Q.
Pratt & Whitney Co., Dundas, Ont.
Petrie, H. W. Toronto.
Sheffield Twist Drill & Steel Co., Ltd., Sheffield, England.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
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Taylor J. A. M., Stair Bldg., Toronto.
Wilt Twist Drill Co. of Can., Walkerville
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

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Cleveland Pneumatic Tool Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Williams Mchy Co, Ltd., A. R., Montreal
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, PNEUMATIC CORNER

Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Chicago.

DRILLS, RATCHET AND HAND

Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

DRILLS, ROCK

Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
The Foss Mchy. & Supply Co., Montreal.
Holden Co., Ltd., Montreal, Que.
Samuel Osborne Ltd., Montreal, P.Q.
Strelinger, Chas. A. Co., Windsor, Ont.
A. R. Williams Machy. Co., Toronto.

DRILLS, SQUARE & HEXAGON

Globe Engineering Co.

DRILLS, TRACK

Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Holden Co., Ltd., Montreal, Que.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

DRINKING FOUNTAINS, SANITARY

Crane, Ltd., Montreal, Que.
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

DRIVES, CHAIN

See Belting, Chain.

DRIVING TOOLS

The Thos. Pink Co., Ltd., Pembroke, Ont.

DRY CLEANING SYSTEM

Bowser Co., Ltd., S. F., Toronto, Ont.

DRYERS, SAND

Lyman Tube & Supply Co., Montreal, Que.

DRYING APPLIANCES

Baird Machine Co., Bridgeport, Conn.
Sturtevant Co., B. F., Galt, Ont.
W. S. Rockwell Co., New York, N.Y.

DRUM CONTROLS

Volta Manufacturing Co., Welland, Ont.

DUMP CARS

Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.

DUST HANDLING EQUIPMENT

Sturtevant Co., B. F., Galt, Ont.

DUST SEPARATORS

Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

DYNAMOS AND ELECTRICAL SUPPLIES

Canadian Fairbanks-Morse Co., Montreal.
MacGovern & Co., Montreal, Que.
Strelinger Co., Chas. A., Windsor, Ont.
A. R. Williams Machy. Co., Toronto.

ELECTRICAL SUPPLIES

Lyman Tube & Supply Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal Que

ELECTRIC FURNACES

Electric Furnace Construction Co., Philadelphia, Pa.
Volta Manufacturing Co., Welland, Ont.

EECTRIC FURNACE REGULATORS, WINCHES, ROOF COOLERS AND ELECTRODE HOLDERS

Volta Manufacturing Co., Welland, Ont.

ELECTRIC HOISTS, STATIONARY AND MONO RAIL

Canadian Link-Belt Co., Ltd., Toronto,
Volta Manufacturing Co., Welland, Ont.

ELECTRIC MOTORS

Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
Volta Manufacturing Co., Welland, Ont.

ELECTRIC TRUCKS

Cowan Truck Co., Holyoke, Mass.

ELEVATOR ENCLOSURES

Volta Mfg. Co., Welland, Ont.
Canada Wire & Iron Goods Co., Hamilton

ELEVATOR WEIGHTS

Katie Foundry, Galt, Ont.

ELEVATORS AND BUCKETS

Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.

ELEVATING AND CONVEYING MACHINERY

Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Petrie, Ltd., H. W., Toronto.

EMBOSSING PRESSES

Dom. Steel Products Co., Ltd., Brantford.
Oliver Machinery Co., Grand Rapids, Mich

EMERY GRINDERS (PNEUMATIC)

Can. Ingersoll-Rand Co., Ltd., Sherbrooke.
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.

EMERY CLOTH

Atkins & Co., E. C., Hamilton, Ont.

EMERY PAPER

Atkins & Co., E. C., Hamilton, Ont.

EMERY AND EMERY WHEELS

Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford, Canada.
The Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.

EMERY WHEEL DRESSINGS

Dominion Abrasive Co., Ltd., Mimico, Ont.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor Ont.

ENAMELWARE

Crane, Ltd., Montreal, Que.

END MILLS

John Morrow Screw & Nut Co., Ingersoll

ENGINEERS—INDUSTRIAL CLEANING (Free Consultation)

Oakley Chemical Co., New York, N.Y.

ENGINEERS

Samuel Osborne (Canada) Ltd., Montreal.

ENGINES, STEAM, GAS, GASOLINE

Furniss, Clarke & Co., Montreal, Que.
Canadian Fairbanks-Morse Co., Montreal.
Holden Co., Ltd., Montreal, Que.
Johnson Mach. Co., Carlyle, Manchester, Conn.
MacGovern & Co., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

ENGINES, HORIZONTAL AND VERTICAL

Hamilton Co., Ltd., Wm., Peterborough, Ont.
Johnson Mach. Co., Carlyle, Manchester, Conn.
Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

ENGINES, OIL

Holden Co., Ltd., Montreal, Que.
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.

ENGINES, HEAVY OIL, DIESEL TYPE

Dom. Steel Products Co., Ltd., Brantford
Holden Co., Ltd., Montreal, Que.

ENGINES, MARINE

Can. Ingersoll-Rand Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

ENGINES, STATIONARY, FUEL, OIL, GAS OR GASOLINE

Holden Co., Ltd., Montreal, Que.

ESCUTCHEON PINS

Parmenter & Bulloch, Gananoque, Ont.

EXHAUST HEADS AND HOODS

Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Sturtevant Co., B. F., Galt, Ont.

EXHAUSTERS

Can. Blower & Forge Co., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
Can. Driver-Harris Co., Walkerville, Ont.

EXTRACTORS, TAP

Walton Co., The, Hartford, Conn.

EYE BOLTS AND NUTS

Can. Foundries & Forgings, Ltd., Welland, Ont.

EYE PROTECTORS

Standard Optical Co., Geneva, N.Y.

FACTORY LOCATIONS

City of St. Johns, Quebec.

FACTORY SITES

City of St. Johns, Quebec.

FANS

Baird Machine Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

FENCE, IRON AND FACTORY

Can. Wire & Iron Goods, Hamilton, Ont

FERRO-TUNGSTEN

Vanadium-Alloys Steel Co., Pittsburgh, Pa

FIBRE, RODS AND SHEETS

Diamond State Fibre Co., Bridgeport Pa.

FILES

Aikenhead Hardware Co., Toronto, Ont
Atkins & Co., Wm., Sheffield, Eng.
Ingersoll File Co., Ltd., Ingersoll, Ont
Morrow Screw & Nut Co., J., Ingersoll, Ont
Marshall, Son & Bunney, Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass
Strelinger, Chas. A. Co., Windsor, Ont
Wilkinson & Kompass, Hamilton, Ont.

FILES, COMMUTATOR SLOTTING

Lyman Tube & Supply Co., Montreal, Que.

FILING MACHINES, BENCH AND MOTOR DRIVEN

Cochrane-Bly Co., Rochester, N.Y., U.S.A

FILTERING AND CIRCULATING SYSTEMS FOR LUBRICATING OIL

Bowser Co., Ltd., S. F., Toronto, Ont.
Can. Wire & Iron Goods, Hamilton, Ont

FIRE BRICK

Elk Fire Brick Co., Hamilton, Ont.
General Combustion Co., Ltd., Montreal, Que.

FIRE CLAY

Elk Fire Brick Co., Can., Ltd., Hamil
General Combustion Co., Ltd., Montreal, Que.

FINISHING MACHINES

Brown & Sharpe Mfg. Co., Providence, R.I.

FITTINGS, CAST IRON, SCREWED, FLANGED

Crane Ltd., Montreal, Que.

FIXTURES

Brown Engineering Corp., Toronto, Ont.
Crescent Mchy. Co., Ltd., Montreal, Que.

FLAT SPRINGS

The Dunbar Brothers Co., Bristol, Conn

FLEXIBLE SHAFT EQUIPMENT

R. C. Haskins Co., Chicago, Ill.

FLOODLIGHTS, ELECTRIC

Holden Co., Ltd., Montreal, Que.
Northern Electric Co., Ltd., Montreal, Que

FLOTATION MACHINERY

Elec. Steel & Metals, Welland, Ont.

FLUMES

Can. Ingersoll-Rand Co., Ltd., Sherbrooke.
William Hamilton Co., Peterboro, Ont.

FORGES, HAND PORTABLE

Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.

FORGE TOOLS

Kimber & Hillier Mfg., Co., St. Catharines, Ont

FORGES, OIL

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

FORGINGS

Mesta Machine Co., Pittsburgh, Pa.
Can. Found. & Forgings, Ltd., Welland
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

FORGINGS, DROP, AUTOMOBILE AND LOCOMOTIVE FORGING AND WELDING

Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamp'g Co., Walkerville
Steel Co. of Canada, Ltd., St. Catharines
Victoria Foundry Co., Ottawa.
Williams & Co., J. H., Brooklyn, N.Y.

FORGING MACHINERY

John Bertram & Sons Co., Dundas, Ont.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
National Machy. Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.

FORGINGS, SPECIAL

Armstrong-Whitworth of Can., Montreal.
Can. Found. & Forgings, Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.

FORMING

Brown & Sharpe Mfg. Co., Providence, R.I.

FOUNDRY EQUIPMENT

Herbert Ltd., Alfred, Toronto, Ont.

FRICTION LEATHERS

Graton & Knight Mfg. Co., Montreal.

FRICTION SURFACE BELTING

Can. Consolidated Rubber Co., Montreal.

FUEL OIL SYSTEMS

Bowser Co., Ltd., S. F., Toronto, Ont.

FURNACES, ANNEALING, CASE HARDENING AND TEMPERING

Bellevue Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Gen. Combustion Co, Can., Ltd, Montreal
Mechanical Eng'r'g Co., Three Rivers, Q.
W. S. Rockwell Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.

FURNACES, BLAST

Bellevue Industrial Furnace Co., Detroit
W. S. Rockwell Co., New York, N.Y.
Toronto Iron Works, Ltd., Toronto.

FURNACES — BRASS MELTING

General Combustion Co., Ltd., Montreal.

FURNACES, ELECTRIC

Electric Furnace Construction Co., Philadelphia, Pa.

FURNACES, FORGING

Gen. Combustion Co. of Can., Ltd., Montreal.
W. S. Rockwell Co., New York, N.Y.

FUSE BOXES, STEEL

Dom. Forge & Stamp. Co., Walkerville

FUSE PLUGS AND FUSES

Northern Electric Co., Ltd., Montreal Que

GALVANIZING FLUX

British Smelting & Refining Co., Ltd. Montreal, Que.

GANG PLANER TOOLS

Armstrong Bros. Tool Co., Chicago.

GAS AND STEAM ENGINES

Mesta Machine Co., Pittsburgh, Pa.

GASKETS, LEATHER, ETC.

Graton & Knight Mfg. Co., Montreal.
Holden Co., Ltd., Montreal, Que.

GASOLINE METERS

Bowser Co., Ltd., S. F., Toronto, Ont.

GASOLINE TANKS

Bowser Co., Ltd., S. F., Toronto, Ont.

DOMINION RUBBER SYSTEM
CANADIAN CONSOLIDATED RUBBER CO. LIMITED AND ASSOCIATED COMPANIES

Industrial Rubber Goods For Every Purpose

No matter what you may need, or what its size or shape, **if it's made of rubber,** we either have it in standard stock goods, or will produce it to meet your requirements.

We carry in stock, at all our branches, standard sizes of Belting, Packing, Gaskets, Fire Hose, and Supplies, Moulded Goods, and every rubber need for mill, factory, mine, lumber camp, shipbuilding, marine, or other industry.

Dominion Rubber System Products

are carefully inspected and tested to insure our high standard.

We maintain a Special Service Department of technical experts who will be glad to analyze your requirements, and specify the correct product to prevent waste, lower upkeep, and maintain maximum production.

This service is yours, without charge, and requires only a 'phone call or wire to our nearest service branch.

Dominion Rubber System Service Branches

Halifax	Toronto	Fort William	Edmonton
St. John	Hamilton	Winnipeg	Calgary
Quebec	London	Brandon	Lethbridge
Montreal	Kitchener	Regina	Vancouver
Ottawa	North Bay	Saskatoon	Victoria

BELTING

Transmission: "Dominion," "Keewatin," "Para."
Conveyor: "Rockproof," "Canadian," "Hiheat."
Elevator: "Dominion," "Rockproof," "Endurance."
Agricultural: "Lumber King," "Star," "Western."
Grain Elevator: "Metcalf Standard," "St. Lawrence," "Grain King."

HOSE

Air: "Kushion Kover," "Para," "4810 Airtite."
Steam: "Indestructible," "Rockproof," "Para."
Water: "Indestructible," "Kushion Kover," "Para."
Suction: "Para," "Star," "Trade."
Garden: "Canadian," "Dominion," "Star."

PACKING

Sheet: "Join-Tite," "Star," "Importers."
Rod: "Cabestos," "Valve-Bestos," "Canadian."
Valves: "Montreal," "Commercial," "Canadian."

MISCELLANEOUS

Mats, Matting and Flooring, Plumbers' Specialties, Rubber Covered Rolls, Friction Tape, Splicing Compound, Dredging Sleeves, Hard Rubber Goods, Tubing, Rinex Soles, Catspaw Heels, Jar Rubbers, Moulded Goods.

If interested tear out this page and place with letters to be answered.

GASOLINE PUMPS, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

GAUGES
Crescent Mach. Co., Ltd., Montreal, P.Q

GAUGERS, CALIPERS
Williams & Co., J. H., Brooklyn, N.Y

GAUGES, DIAL
Herbert, Ltd., Alfred, Toronto, Ont.

GAUGES, MERCURY COLUMN, DRAFT
Taylor Instrument Co., Rochester, N.Y.

GAUGES, HYDRAULIC
Taylor Instrument Co., Rochester, N.Y.

GAUGES, MANUFACTURERS, LIMIT, THREAD
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Can., Galt, Ont

GAUGES, SNAP, THREAD AND CYLINDRICAL
C. E. Johanson, Inc., Toronto, Ont.

GAUGES, VACUUM AND PRESSURE
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Rochester, N.Y

GAUGES, STANDARD
Brown Engineering Corp., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Crescent Mche. Co., Ltd., Montreal, Que.
Garvin Machine Co., New York.
C. E. Johanson, Inc., Toronto, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Hartford, Conn
Strelinger, Chas. A. Co., Windsor, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Wells Brothers Co. of Canada, Galt, Ont.

GEAR BLANKS
Can. Steel Foundries, Ltd., Montreal,
Dom. Found. & Steel, Hamilton, Ont.
Williams & Co., J. H., Brooklyn, N.Y

GEAR BLANKS, CAST
Katie Foundry, Galt, Ont.

GEAR BLANKS, RAWHIDE
Lyman Tube & Supply Co., Montreal, Que.

GEAR BOXES, REDUCTION
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEAR SHAPERS AND CUTTERS
Fellows Gear & Shaper Co., Springfield, V.

GEAR-CUTTING MACHINERY
Bilton Mach. Tool Co., Bridgeport, Conn.
Fellows Gear & Shaper Co., Springfield, V.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

GEAR-TESTING MACHINE
Gisholt Machine Co., Madison, Wis.

GEARS, CHAIN
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.
Renold of Canada Ltd., Montreal.

GEARS, COMPENSATING
Morse Chain Co., Ithaca, New York.
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, CUT, MORTISE, ANGLE, WORM
Can. Link-Belt Co., Toronto, Ont.
Diamond State Fibre Co., Bridgeport, Pa.
Dom. Steel Products Co., Ltd., Brantford
Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Found., Ltd., Hull, Q.
Jones & Glasseo, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia
Victoria Foundry Co., Ottawa.

GEARS, RAWHIDE
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough,
Jones & Glasseo, Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
A. R. Williams Machy. Co., Toronto.

GENERATORS, GEAR
Fellows Gear & Shaper Co., Springfield, V

GEARS, SILENT CHAIN
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, SPRING
Morse Chain Co., Ithaca, New York.

GEARS, SPUN, BENCH, SPIRAL
Brown & Sharpe Mfg. Co., Providence, R.I.

GENERATORS AND CONVERTORS
Northern Elec. Co., Ltd., Montreal, P.Q.

GENERATORS, MOTOR
MacGovern & Co., Montreal.
Northern Elec. Co., Ltd., Montreal, P.Q.
Sturtevant Co., B. F., Galt, Ont.

GENERATORS, STEAM TURBO
Can Link-Belt Co., Ltd., Toronto, Ont.
Holden Co., L. C., Montreal, Que.

GILDING
Brown's Copper and Brass Rolling Mills New Toronto.

GLUE HEATERS
Oliver Machinery Co., Grand Rapids, Mich

GLASSES, SAFETY
Willson Goggles, Inc., Reading, Pa.

GRAPHITE
Aikenhead Hardware, Ltd., Toronto.
Rice Lewis & Son, Toronto.

GOGGLES
Standard Optical Co., Geneva, N.Y.

GRAB BUCKETS—CLAMSHELL and ORANGE PEEL
Canadian Link-Belt Co., Ltd., Toronto, Ont.

GRAVITY CARRIERS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glasseo, Montreal.
Morris Crane & Hoist Co., Ltd., Herbert Niagara Falls, Ont.

GREASE CUPS, PRESSED STEEL, BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES (See Lubricants)

GRINDERS, AUTOMATIC KNIFE
Canada Machinery Corp., Galt, Ont.
Foss Mchry. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto.

GRINDERS, AUTOMATIC SURFACE
La Salle Tool Co., La Salle, Ill.

GRINDERS, BENCH
Superior Machinery Co., London, Ont.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Can. Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Haskins & Co., R. C., Chicago, Ill.
Wisconsin Electric Co., Inc., Racine, Wis
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Katie Foundry, Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec. Tool Co., Cincinnati.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CUTTER
Brown & Sharpe Mfg. Co., Providence, R.I
Cincinnati Milling Mach. Co., Cincinnati.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Globe Engineering Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester Mass.
Herbert, Ltd., Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, DIE AND CHASER
Haskins & Co., R. C., Chicago, Ill.
Landis Machine Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., E. C., Hamilton, Ont.
Ford-Smith Mach. Co. Hamilton.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., Worcester, Mass.

GRINDERS, FLEXIBLE CASTING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, DRILL
Aikenhead Hardware Co., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
La Salle Tool Co., La Salle, Ill.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CYLINDER, INTERNAL
Brown & Sharpe Mfg. Co., Providence, R.I
Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, PORTABLE, ELECTRIC HAND, TOOL POST, FLOOR AND BENCH
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford Smith Mach. Co., Hamilton, Ont.
Haskins & Co., R. C., Chicago, Ill.
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
United States Elec. Tool Co., Cincinnati
Wisconsin Electric Co., Inc., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

GRINDERS, HOLE, HOLE AND AND DEEP HOLE
Barber Mchy. Co., Ltd., Toronto, Ont.
Bryant Chucking Grinder Co., Springfield, Vermont.
Heald Machine Co., Worcester, Mass.

GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co., Toronto.
Garlock-Walker Machinery Co., Toronto.
Heald Machine Co., Worcester, Mass.
Independent Pneumatic Tool Co., Chicago
MacGovern & Co., Montreal, Que.

GRINDERS, PROFILE
Cleveland Milling Machine Co., Cleveland.

GRINDERS, ROTARY SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Bristol Machine Tool Co., Bristol, Conn.
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, TOOL AND HOLDER
Armstrong Bros. Tool Co., Chicago.
Blount & Co., J. G., Everet, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
Herbert, Ltd., Alfred, Toronto, Ont.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

GRINDERS, UNIVERSAL, PLAIN
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

GRINDERS, VERTICAL, SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Montreal.
Heald Machine Co., Worcester, Mass.
Herbert, Ltd., Alfred, Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Norton Co. of Canada, Ltd., Hamilton, Ont
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDING AND POLISHING MACHINES, PORTABLE, PNEUMATIC AND SPRING FRAME
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Elec. Tool Co., Cincinnati. O
Ford-Smith Mach. Co., Hamilton, Ont
Gardner & Son, Robt., Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Haskins & Co., R. C., Chicago, Ill.
Hall & Sons, John H., Brantford, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Niles-Bement-Pond Co., New York, N.Y
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
Wisconsin Electric Co., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

GRINDING MACHINES, CAR WHEEL, CUTTER, CYLINDRICAL CRANKSHAFT
Brown & Sharpe Mfg. Co., Providence, R.I
Norton Co. of Canada, Ltd., Hamilton, Ont.

GRINDING WHEELS
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford
Can. Fairbanks-Morse Co., Montreal.
Carborundum Co., Niagara Falls, N.Y
Dominion Abrasive Wheel Co., Ltd. Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Mchy. & S'ply Co. G. F., Montreal
Norton Co. of Canada, Ltd., Hamilton, Ont.

GRINDING WHEEL DRESSER
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Norton Co. of Canada, Ltd., Hamilton, Ont.

GUARDS, WINDOW AND MACHIN
Canada Machinery Corp., Galt, Ont.
Canada Wire & Iron Goods Co., Hamilton
Dennis Wire & Iron Works, London, Ont
B. Greening Wire Co., Hamilton Ont.

GUTTERS AND SKYLIGHTS
H. H. Robertson, Ltd., Sarnia, Ont

HACK SAW BLADES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Ford-Smith Machine Co., Hamilton, Ont
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Pilot Steel & Tool Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
L. S. Starrett Co., Athol, Mass.
Standard Machy. & Supplies, Montreal
Strelinger, Chas. A. Co., Windsor, Ont.
Victor Saw Works, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.
Williams Mchy Co., A. R., Toronto, Ont.

HANDLES, BALANCE, CRANK AND MACHINE
Williams & Co., J. H., Brooklyn, N.Y.

HANGERS, SHAFT
Can. Link-Belt Co., Ltd. Toronto, Ont

HACK SAW FRAMES
Aikenhead Hardware Co., Toronto.
Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont
Garvin Machine Co., New York City.
Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.

HACK SAWS, POWER
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Foss Mchy. & S'ply Co., G. F., Montreal
Ford-Smith Machine Co., Hamilton.
Perfect Machine Co., Galt, Ont.
Starrett Co., L. S., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont

HAMMERS, FORGING
Nazel Eng. & Mach. Wks., Philadelphia

HAMMERS, ELECTRIC
Hoskins & Co., R. C., Chicago, Ill.

HAMMERS (DROP), MOTOR AND BELT DRIVEN
Beaudry & Co., Boston, Mass.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton.
Canada Machinery Corp., Galt, Ont.
High Speed Hammer Co., Rochester, N.Y
Jardine & Co., A. B., Hespeler, Ont.
Niles-Bement-Pond Co., New York, N.Y
Petrie, Ltd., H. W., Toronto
Strelinger, Chas. A. Co., Windsor, Ont.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

HAMMERS, HELVE POWER
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

HAMMERS, CHIPPING, CAULKING, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, NAIL MACHINE
Rice Lewis & Son, Toronto, Ont.
United Hammer Co., Boston, Mass.

HAMMERS, POWER
Nazel Eng. & Mach. Wks., Philadelphia

HAMMERS, STEAM
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.

HAND PLANERS
Oliver Mchry. Co., Grand Rapids, Mich.

HAND PLANING AND JOINTING MACHINERY
Oliver Engineering Co., Montreal, P.Q.

HAND LEATHERS OR PADS
Graton & Knight Mfg. Co., Montreal.

HANDLES, FIBRE
Diamond State Fibre Co., Bridgeport, Pa.

HANGERS
Brown & Sharpe Mfg. Co., Providence, R.I
Canadian Link-Belt Co., Ltd., Toronto, Ont.

HANGERS, SHAFT
Algoma Steel Corp., Sault Ste. Marie.
Chapman Double Ball Bearing Co., Toronto.
Baird Machine Co., Bridgeport, Conn
Can. S K F Co., Toronto, Ont.
Gardner & Son, Robt., Montreal.
Jones & Glasseo, Montreal.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

HARDNESS TESTING INSTRUMENTS
Shore Instrument & Mfg. Co., New York

HEAD, AUXILIARY
Hoefer Mfg. Co., Freeport, Ill.

HEATING AND VENTILATING ENGINEERS
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

HEAT GAUGES, HARDENING AND ANNEALING
Shore Instrument & Mfg. Co., New York

HIGH SPEED STEEL
See Steel.

HINGE MACHINERY
Baird Machine Co., Bridgeport, Conn.

HINGES
Butterfield & Co., Inc., Rock Island, Que.
London Bolt & Hinge Wks., London, Ont.

HOBS
Greenfield Tap & Die Co., Greenfield, Mass
Pratt & Whitney Co., Dundas, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Wells Bros. of Canada, Galt, Ont.

HOBBING MACHINES
Herbert, Ltd., Alfred, Toronto, Ont.

HOISTS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Holden Co., Ltd., Montreal, Que
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.

HOISTS, CHAIN AND PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Ford Chain Block & Mfg., Philadelphia.
Independent Pneumatic Tool Co., Chicago
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Wright Mfg. Co., Lisbon, Ohio.
Williams Mchy Co, Ltd., A. R., Montreal

THE GARVIN PAGE

Published by

THE GARVIN MACHINE CO.

Builders of Machine Tools since 1865

Since 1865—A Steady Customer

Way back when we were just starting out in business, we were given an order to build machine tools for a manufacturer who was one of the big ones of those days.

We have the faded pen and ink original of that order hanging framed on our office wall. It marked our real start as builders of machine tools.

That concern has grown hundreds of times bigger in the passing years. We have sold it thousands of tools since that early order, many quite recently, and are proud to number it among our good friends and customers to-day.

We are glad to have given service which merited continued confidence, but, after all, that customer has received no more than any one of thousands of others.

"Personal attention" means just what the words say, in the Garvin office and works. Our way of doing business cuts out the routine of shunting things from one department to another. A letter or an order comes in and goes straight to the man who knows the how and why. You get immediate shipment or a full and frank reply—real service.

Did you ever stop to think of a machine tool manufacturing house as a place where human folks did business in a human way?

H. R. GARVIN.

Milling Machines

that have no "temperament"

There are machine tools that are just as "cranky" and have to be humored like some of those artist chaps who suffer from temperament—and can only work right when conditions are just so.

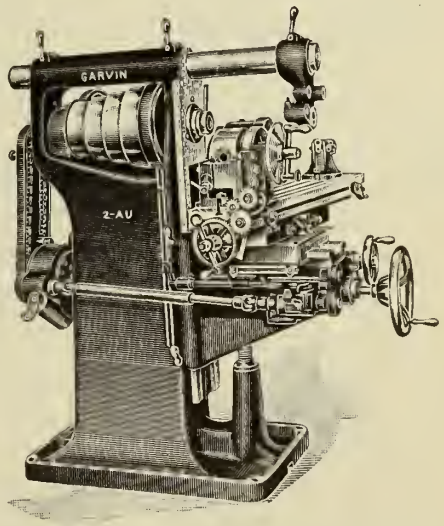
Garvin Milling Machines aren't that kind. They are the sort that start in fresh every morning, put in a full day's work and are ready to work overtime if there's a rush.

Not that they are heavy or crude—far from it. They have all the refinements and delicacy of touch that make for fine work. But at that their simplicity and strength all through makes it easy for them to stand the gaff of heavy cuts and hard-pushed service.

There's too much to be said about the fine points of their design to even start here. Let's save that for the catalog and leaflets to tell you.

There are individual circulars on the various sizes of plain, hand and universal types and a complete catalog of the Garvin line—tell us the size and type you contemplate buying.

The
Garvin Machine Co.
Spring and Varick Streets
New York, N.Y.



No. 2A Universal Miller

GARVIN

BUILDER OF BETTER MACHINE TOOLS

HOISTS, ELEC., STATIONARY, MONO RAIL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Oliver Engineering Co., Montreal.
Volta Mfg. Co., Welland, Ont.

HOISTS, ELECTRICAL
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
Electric Steels & Metals Ltd., Welland.
Kennedy & Sons, Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

HOLDERS, ADJUSTABLE LENGTH
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

HOLDERS, ELECTRIC
Electric Steels & Metals, Ltd., Welland

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Clipper Belt Lacer Co., Grand Rapids.

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MacKinnon Steel Co., Ltd., Sherbrooke.
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William Hamilton Co., Peterboro, Ont.
Toronto Iron Works, Ltd., Toronto, Ont.

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Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal

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Garlock-Walker Machinery Co., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Independent Pneumatic Tool Co., Chicago.
Quaker City Rubber Co., Philadelphia, Pa.
Wells Bros. Co. of Canada, Galt, Ont.

HOSE, ALL KINDS
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Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HOSE, SAND BLAST
Goodyear Tire & Rubber Co. of Can., Ltd. Toronto
Quaker City Rubber Co., Philadelphia, Pa.

HOSE, STEAM, SUCTION AND WATER
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HUMIDIFIERS
Sturtevant Co., B. F., Galt, Ont.

HYDRAULIC ACCUMULATORS
Dom. Steel Products Co., Ltd., Brantford.

HYDRAULIC MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford.
Eastern Production Co., Detroit, Mich.
Garlock-Walker Machinery Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Victoria Foundry Co., Ottawa.

HYDRAULIC TURBINES
Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

HYDROMETERS, HYGROMETERS, HYGRODNIKS
Taylor Instrument Co., Rochester, N.Y.

INDICATORS, SPEED
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

INDEX CENTRES
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Petrie, Ltd., H. W., Toronto.

INDICATING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

INDUSTRIAL SITES
City of St. Johns, Quebec.

INGOTS, FORGING AND ROLLING
Electric Steel & Metals Co., Welland.

INSULATING COMPOUNDS
Robertson Co., Ltd., H. H., Sarnia, Ont.

IRON ORE
Hanna & Co., M. A. Cleveland, O.

IRON, WROUGHT, ROLLED, PIG
Swedish Steel & Impt. Co., Ltd., Montreal

JACKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Engineering Co.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.

JACKS, PIT AND TRACK
Canadian Fairbanks-Morse Co., Montreal
Lyman Tube & Supply Co., Montreal, Que.
Northern Crane Works, Walkerville.

JAWS, FACE PLATE
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Skinner Chuck Co., New Britain, Conn.

JIGS, TOOLS, ETC.
Ackworthie Ltd., J., Birmingham, Eng.
Brown Engineering Corp., Toronto.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Gisholt Machine Co., Madison, Wis.
Globe Engineering Co., Ltd., Hamilton.
Jones & Lamson, Springfield, Vt.

JOURNAL WEDGES
Canada Foundries & Forgings, Welland.
Dominion Foundries & Steel Ltd., Hamilton, Ont.

KEY SEATERS
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, M.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Machy. Co., A. R., Toronto.

KEYS, MACHINE
Williams & Co., J. H., Brooklyn, N.Y.

KILNS
Can. Blower & Forge Co., Kitchener, Ont.
General Combustion Co., Ltd., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

KNIVES, MACHINE
Atkins & Co., E. C., Hamilton, Ont.

LABORATORIES, INSPECTION AND TESTING (see Chemists)

LADLES, FOUNDRY
Northern Crane Works, Walkerville.

LACING MACHINES
Clipper Belt Lacer Co., Grand Rapids, M.

LAG SCREW GIMLET POINTERS
National Machy. Co., Tiffin, Ohio.

LATH
Robertson, Ltd., H. H., Sarnia, Ont.

LATHES, CHUCKING
Acme Machine Tool Co., Cincinnati, Ohio.
Petrie, Ltd., H. W., Toronto.

LATHE CHUCKS (See Chucks)

LATHE DOGS AND ATTACHMENTS
Armstrong Bros. Tool Co., Chicago.
Hendey Machine Co., Torrington, Conn.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

LATHES, AUTOMATIC AND SEMI AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Herbert, Ltd., Alfred, Toronto, Ont.

LATHES, AXLE
Betts Mach. Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, BORING
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.

LATHES, PRECISION, BENCH
J. G. Blount & Co., Everett, Mass.
Canadian Fairbanks-Morse Co., Montreal
Geo. F. Foss Machy. & Supply Co. Montreal.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Seneca Falls Mfg Co., Seneca Falls, N.Y.
Strelinger Co., C. A., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, BRASS
Ackworthie Ltd., J., Birmingham, Eng.
Acme Machine Tool Co., Cincinnati, Ohio.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, ENGINE
Acme Machine Tool Co., Cincinnati, O.
John Bertram & Sons, Co., Dundas.
Canada Machy. Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal.
G. F. Foss, Mchy. & S'ply Co., Montreal
Garlock-Walker Machinery Co, Toronto.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
Lehman Mach. Co., St. Louis, Mo.
R. McDougall Co., Galt.
Niles-Bement-Pond Co., New York.
Perfect Machine Co., Galt, Ont.
Standard Equipment & Tool Wks, Montreal, P.Q.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Sidney Tool Co., Sidney, Ohio.
Strelinger Co., C. A., Windsor, Ont.
Walcott Lathe Co., Jackson, Mich
A. R. Williams Machy. Co., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, FOOT POWER
Seneca Falls Mfg. Co., Seneca Falls, N.Y.

LATHES, HORIZONTAL
Herbert, Ltd., Alfred, Toronto, Ont.
Intern'l. Mchy. Supplies Ltd., Montreal.

LATHES, JOURNAL TRUEING
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, PATTERNMAKERS'
J. G. Blount Co., Everett, Mass.
Can. Machinery Corp., Galt.
G. F. Foss Mchy. & S'ply Co., Montreal
Garlock-Walker Machy. Co., Toronto Ont

LATHES, POLISHING
Ackworthie Ltd., J., Birmingham, Eng.
Greenfield Tap & Die Corp., Greenfield
Wells Bros. of Canada, Galt, Ont.

LATHES, SCREW CUTTING
Bertram & Sons Co., John, Dundas, Ont.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & Sply Co., G. F., Montreal
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Lehman Machine Co., St. Louis, Mo.
Niles-Bement-Pond Co, New York.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Strelinger Co., C. A., Windsor, Ont.
Williams Machy. Co., A. R., Toronto.

LATHES, SPINNING
Bliss Co., E. W., Brooklyn, N.Y.

LATHES, TOOL ROOM
Canada Machinery Corporation, Galt, Ont.
Lehman Machine Co., St. Louis, Mo.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Strelinger, Chas. A. Co., Windsor, Ont.

LATHES, QUICK CHANGE
Lehman Machine Co., St. Louis, Mo.

LATHE SAWS
Atkins & Co., E. C., Hamilton, Ont.

LATHES, TURRET
Acme Machine Tool Co., Cincinnati, Ohio
Herbert Ltd., Alfred, Toronto, Ont.

LEAD, PIG AND BAR
British Smelting & Refining Co., Ltd., Montreal, Que.
Hoyt Metal Co., Toronto, Ont.

LEAD BURNING OUTFITS
Turner Brass Works, Sycamore, Ill.

LEATHER STRAPPING
Graton & Knight Mfg. Co., Worcester, M.

LENSES FOR GOGGLES
Standard Optical Co., Geneva, N.Y.

LEVELS
Hughes, Owens Co., Ltd., Montreal, Que.

LIDS, SCREW TOP AND HINGE
Can. Winkley Co., Ltd., Windsor, Ont.

LINK BELTING
See Belting, Chain.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LOCKERS, STEEL WARDROBE AND STEEL MATERIAL
Canada Wire & Iron Gds. Co., Hamilton
Dennis Wire & Iron Works, London, Ont

LUBRICANTS
Cataract Refining & Mfg. Co., Toronto.
Swan & Finch, Inc., New York.

LUBRICANTS, CUTTING AND GRINDING, DRAWING, STAMPING
Oakley Chemical Co., New York, N.Y.

LUBRICATING, OIL FILTERING AND CIRCULATING SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.

LUBRICATORS
Trabern Pump Co., Rockford, Ill.

LUMBERMEN'S TOOLS
Thos. Pink Co., Ltd., Pembroke, Ont.

MACHINE COUNTER WEIGHTS
Katie Foundry, Galt, Ont.

MACHINE TOOLS
Barber Mach. Co., F. F., Toronto, Ont

MACHINERY DEALERS
Archibald & Co., Chas. P., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machy. Co., Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Machy. Co., A. R., Toronto.

MACHINERY GUARDS (See Guards)

MACHINERY SUPPLIES
Crescent Machine Co., Ltd., Montreal.
Globe Engineering Wks., Hamilton, Ont

MACHINERY, SPECIAL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Que.
McClean Machine & Tool Co., Ltd., Hamilton, Ont.

MACHINISTS' TOOLS
Atkins & Co., E. C., Hamilton, Ont
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

MAGNETIC BRAKES FOR ELECTRIC MOTORS
Volta Mfg. Co., Welland, Ont.

MANDRELS
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.

MARKING MACHINERY
Brown, Boggs Co., Hamilton, Ont.
Foss Mchy & S'ply Co. G. F., Montreal
Perrin, Wm. R., Toronto.
Petrie, Ltd., H. W., Toronto.

MATS, RUBBER MATTING
Quaker City Rubber Co., Philadelphia, Pa
International Mchy. Sply., Ltd., Montreal

MEASURING MACHINES
Pratt & Whitney Co., Dundas, Ont.

MEASURES, REGISTERING
Bowser Co., Ltd., S. F., Toronto, Ont.

MEASURING TAPES AND RULES
Chesterman & Co., Jas., Sheffield, Eng

MERCHANTS, IRON AND STEEL
Samuel Osborne (Can.), Ltd., Montreal

METALLURGISTS
See Chemists.

METAL CLEANERS
Oakley Chemical Co., New York, N.Y.

METAL CUTTING MACHINES
Atkins & Co., E. C., Hamilton, Ont
Lyman Tube & Supply Co., Montreal, Que.

METAL SAWS
See Saws.

METAL SAWS, POWER
A. C. Atkins & Co., Inc., Indianapolis
Hoefer Mfg. Co., Freeport, Ill.
Lyman Tube & Supply Co., Montreal, Que.

METALS
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper & Brass Rolling Mills New Toronto, Ont.
Canada Metal Co., Toronto, Ont.
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
Hoyt Metal Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.

METAL, STAMPINGS, SMALL
Can. Winkley Co., Ltd., Windsor, Ont.

METERS, OIL, GASOLINE, KEROSENE, ETC.
Bowser Co., Ltd., S. F., Toronto, Ont.
General Combustion Co., Ltd., Montreal, Que.

MICROMETERS
Taylor, J. A. M., 318 Stair Bldg., Toronto.
Petrie, Ltd., H. W., Toronto.

MILLS, BRACE AND TUBE
Elec. Steel & Metals, Welland, Ont.

MILL SPECIALTIES
Atkins & Co., E. C., Hamilton, Ont.

MILLS, SAND
Frost Mfg. Co., Chicago, Ill.

MILL MACHINERY
Alexander Fleck, Ltd., Ottawa.
Greenfield Tap & Die Corp., Greenfield
Wells Bros. of Canada, Galt, Ont.

MILLING ARBORS
Ackworthie Ltd., J., Birmingham, Eng.
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee Wis.
Strelinger, Chas. A. Co., Windsor, Ont.

MILLING ATTACHMENTS
Ackworthie Ltd., J., Birmingham, Eng.
Bertram & Sons Co., John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Hendey Mach. Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.

MILLING MACHINES, AUTOMATIC
Bilton Mach. Tool Co., Bridgeport, Conn
Brown & Sharpe Mfg. Co., Providence, R.I.
Betts Machine Co., Rochester, N.Y.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.

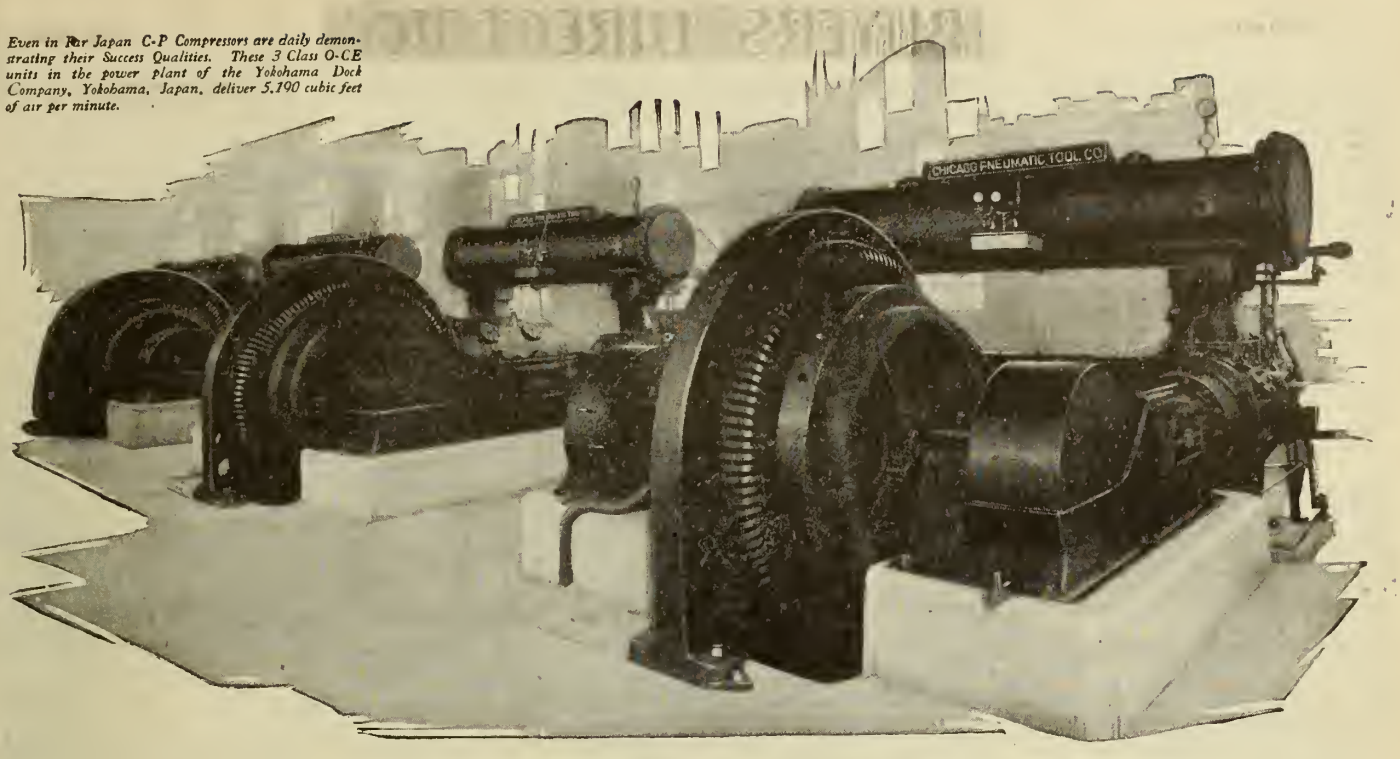
MILLING CUTTERS
Atkins & Co., Ltd., Wm., Sheffield, Eng
Butterfield & Co., Inc., Rock Island, Que
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Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
Herbert, Ltd., Alfred, Toronto, Ont.
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Marshall, Son & Bunney, Toronto.
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Strelinger, Chas. A. Co., Windsor, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

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MILLING MACHINES, THREAD
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United States Mach. Tool Co., Cincinnati
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Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.
Strelinger, Chas. A. Co., Windsor, Ont.

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Bristol Machine Tool Co., Bristol, Conn
Brown & Sharpe Mfg. Co., Providence
Bertram & Sons Co., John, Dundas, Ont
Canada Machinery Corp., Galt, Ont.
Cochrane-Bly Co., Rochester, N.Y., U.S.A
Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Toronto, Ont
Herbert, Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Ltd., H. W., Toronto.
Rockford Milling Mach. Co., Rockford, Ill
Strelinger, Chas. A. Co., Windsor, Ont
United States Mach. Tool Co., Cincinnati
Williams Machy Co., A. R., Toronto.

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The *success qualities* of Chicago Pneumatic Air Compressors are these features, embodied in over three hundred sizes and types:

Simplate flat-disc indestructible valves, exceptionally large bearing surfaces, totally enclosed frame construction—

—automatic lubrication throughout, automatic regulation (insuring high operating economy under variable loads)—

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C 60 H

BOYER PNEUMATIC HAMMERS · · LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
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GIANT OIL AND GAS ENGINES ROCK DRILLS · · COAL DRILLS

CHICAGO PNEUMATIC

The Compressor with the Simplate Valve

If interested tear out this page and place with letters to be answered.

Foss Mchy. & S'ply Co., G. F., Montreal.
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Garvin Machine Co., New York.
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National Machy. Co., Tiffin, Ohio.
Gooley & Eglund, Inc., Cortland, N.Y.
Handey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.
Strelinger, Chas. A. Co., Windsor, Ont.

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Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Brown & Sharpe Mfg. Co., Providence.
Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Dominion Bridge Co., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Pratt & Whitney Co., Dundas, Ont.

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Elec. Steel & Metals, Welland, Ont.
Holden Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Frost Mfg. Co., Chicago, Ill.

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MORTISING MACHINES

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Garlock-Walker Machy. Co., Toronto, Ont.

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Garlock-Walker Machy. Co., Toronto, Ont. Toronto.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Sturtevant Co., B. F., Galt, Ont.
Volta Mfg. Co., Welland, Ont.
Williams Mach'y Co., A. R., Toronto.

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MOTORCYCLE FRAME AND FORK

The Dunbar Brothers Co., Bristol, Conn.

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Cleveland Pneumatic Tool Co., Toronto.
Holden Co., Ltd., Montreal, Que.

MOULDS, RUBBER

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

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Graton & Knight Mfg. Co., Worcester, M.

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Nat. Automatic Tool Co., Richmond, Ind.

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NICHROME CASTINGS

Can. Driver-Harris Co., Ltd., Walkerville.

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Pilot Steel & Tool Co., Montreal, Que.

NICKEL STEEL

See Steel.

NICKEL SILVER—SHEETS, ROLLS, PLATES and RODS

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Landis Machine Co., Waynesboro Pa.
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Williams & Co., J. H., Brooklyn, N.Y.

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NUT FACING AND BOLT SHAVING MACHINES

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National Machinery Co., Tiffin, Ohio.
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Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

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Carborundum Co., Niagara Falls N.Y.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Norton Co., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

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Wells Bros. of Canada, Galt, Ont.

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Brantford Oven & Rack Co., Brantford.
MacKinnon Steel Co., Sherbrooke, Que.

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Prest-o-Lite Co., Inc. Toronto, Ont.
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Nat. Electro Products Ltd., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.

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Gutta Percha & Rubber, Ltd., Toronto.
MacKinnon Steel Co. Sherbrooke, Que

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See Guards

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MacKinnon Steel Co., Sherbrooke, Que.

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PATTERN MAKERS' LATHES

See Lathes.

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Wells Bros. Co. of Canada, Galt, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

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PIERCING

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Greenfield Tap & Die Corp., Greenfield
Wells Bros. Co. of Canada, Galt, Ont
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

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Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

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Wells Bros. of Canada, Galt, Ont.

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PLANER JACKS

Armstrong Bros. Tool Co., Chicago.

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Bertram & Sons Co., John, Dundas.
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Gardner & Son, Robt., Montreal.
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York
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Morton Mfg. Co., Muskegon Heights, Mich
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Garvin Machine Co., New York.
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Niles-Bement-Pond Co., New York.
Perrin, Ltd., William, Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co. Ltd., A. R., Montreal

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MacGovern & Co., Montreal, Que.
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Sturtevant Co., B. F., Galt, Ont.

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Rice Lewis & Son, Toronto, Ont.

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Cleveland Pneumatic Tool Co., Can., Toronto.
Curtis Pneumatic Machy. Co., St. Louis.
Garlock-Walker Machy. Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Chicago.
Int. Mach. & Supply Co., Ltd., Montreal.
Strelinger, Chas. A. Co., Windsor, Ont.

POWER CRANES, HAND

MacKinnon Steel Co., Sherbrooke, Que.

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Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.

POLISHING PLATES

Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. of Canada, Galt, Ont.

POTS AND KETTLES, CAST STEEL

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Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Herbert. Niagara Falls, Ont.

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Hoskins & Co., R. C., Chicago, Ill.

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Canadian Link-Belt Co., Ltd., Toronto.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Petrie, Ltd., H. W., Toronto.

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Atlas Press Co., Kalamazoo, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.
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Lourie Manufacturing Co., Springfield, Ill.

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Bliss Co., E. W., Brooklyn, N.Y.
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Eastern Production Co., Detroit, Mich.
Metalwood Mfg. Co., Detroit, Mich.
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Stoll Co., D. H., Buffalo, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal

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Bliss Co., E. W., Brooklyn N.Y.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.

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Eastern Production Co., Detroit, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Toledo Machine & Tool Co., Toledo.

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Bliss Co., E. W., Brooklyn, N.Y.
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Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co, Toledo.

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Bertram & Sons Co., John, Dundas.
Can. Ingersoll-Rand Co., Ltd. Sherbrooke.
Dom. Steel Products Co., Ltd., Brantford
Eastern Production Co., Detroit, Mich.
Lourie Manufacturing Co., Springfield, Ill.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo
Stoll Co., Inc., D. H., Buffalo, N.Y.
Williams Machy. Co., A. R., Toronto.

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Eastern Production Co., Detroit, Mich.

PRESSES, HYDRAULIC, VERTICAL

Eastern Production Co., Detroit, Mich.

PRESSES, HYDRO-PNEUMATIC

Eastern Production Co., Detroit, Mich.

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Morton Travelling Head Planer

Handles Large or Small Work With Equal Economy

With the Morton Travelling Head Planer you can tackle the most difficult jobs with the certainty of being able to complete them economically and expeditiously. It handles both large and small work with maximum economy. The multiplicity of operations of the Morton Travelling Head Planer makes possible the complete machining of difficult jobs at one setting of the casting. This tool operates as a draw-cut planer, but may be quickly converted to operate with a push cut. It bores, mills and drills at right angles to the ram, as well as in the same plane. Special attachments may be obtained for spherical boring.

Special Features

It may be used either as a portable or stationary machine as the bottom side of the bed is planed.

It is reversible and may be quickly converted into a large, horizontal, travelling head slotter.

All milling, boring and planing feeds and adjustments may be quickly changed to meet conditions.

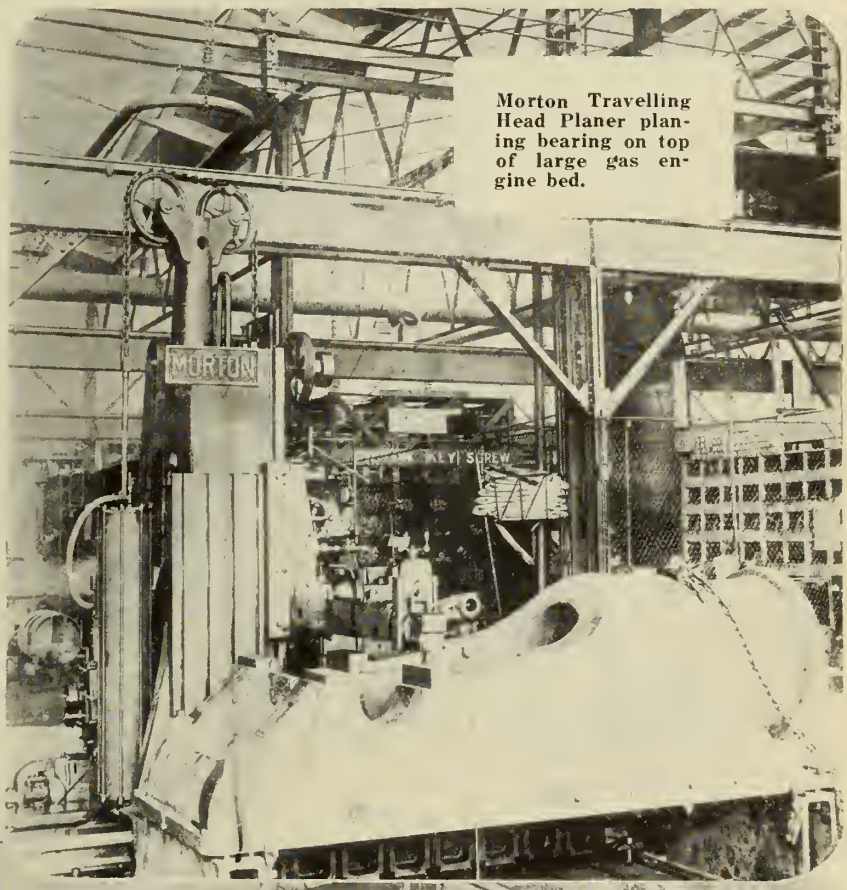
It will vertical mill and drill at right angles with the ram, at any 90-degree point of an arc.

Every operating lever is within easy reach of the operator.

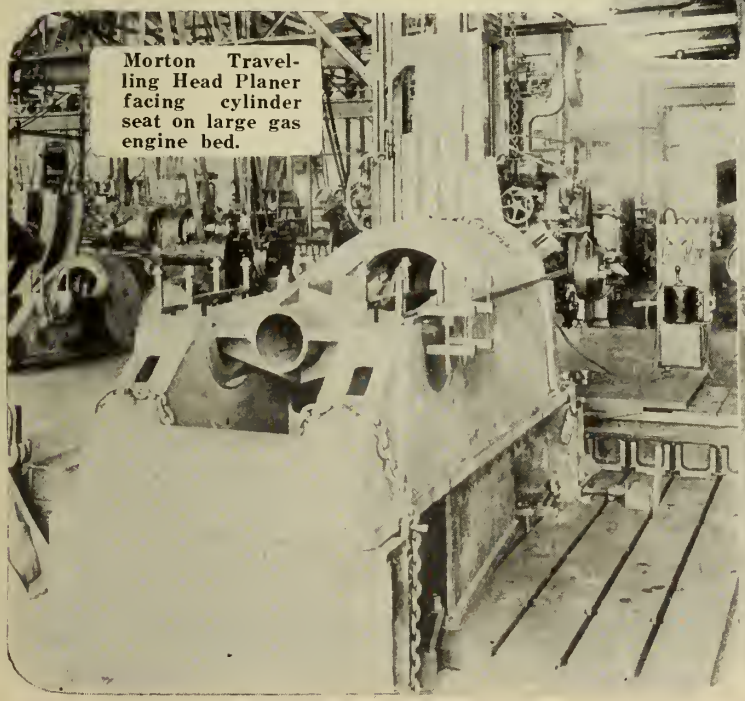
It requires one-half the floor space and one-fourth the power of a housed planer of equal capacity.

Complete Information in Bulletin No. 8 A
Write for it to-day.

Morton Mfg. Co.
Muskegon Heights, Mich., U. S. A.



Morton Travelling Head Planer planing bearing on top of large gas engine bed.



Morton Travelling Head Planer facing cylinder seat on large gas engine bed.



Morton Travelling Head Planer facing journal end on large gas engine bed.

If interested tear out this page and place with letters to be answered.

PRESSES, POWER
Baird Machine Co., Bridgeport, Conn.
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Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Machy. Co . A. R., Toronto

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Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

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Bliss Co., E. W., Brooklyn, N.Y.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.

PRESSES, TIRE
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

PRESSES, TRIMMING
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Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.

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PROJECTORS, FLOOD LIGHTING
Holden Co., Ltd., Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que

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PROTECTIVE COATINGS
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Taylor Instrument Co., Rochester, N.Y.

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American Pulley Co., Philadelphia.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., Fortierville, Que.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Diamond State Fibre Co., Bridgeport, Pa.
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Kennedy & Sons, Ltd., W., Owen Sound.
Positive Clutch & Pulley Works Ltd., Toronto.
Petrie, Ltd., H. W., Toronto.

PULLEYS, STEEL SASH, STEEL BELT
American Pulley Co., Philadelphia, Pa.

PULLEYS, FRICTION, CLUTCH
American Pulley Co., Philadelphia, Pa.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., A., Fortierville, Q
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mch. Co., Manchester, Ct.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Jones & Glassco, Montreal.
Positive Clutch & Pulley Works, Toronto.
Petrie, Ltd., H. W., Toronto.

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Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

PUMPS, AIR LIFT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Holden Co., Ltd., Montreal, Que.

PUMPS, BOILER FEED
Can. Ingersoll-Rand Co., Ltd. Sherbrooke,

PUMPS, CENTRIFUGAL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Darling Bros., Ltd., Montreal, Que.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, FUEL OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS, GEARED
Darling Bros., Ltd., Montreal, Que
Globe Engineering Co., Hamilton, Ont.

PUMPS, HIGH PRESSURE
Perrin, Ltd., William R., Toronto.

PUMPS, HYDRAULIC
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Clarke & Co., Furnies, Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Darling Bros., Ltd., Montreal, Que
Elec. Steel & Metals, Welland, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co . A. R., Toronto, Ont.

PUMPS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, RETURN AIR
Can. Ingersoll-Rand Co. Ltd., Sherbrooke,

PUMPS, SPECIAL
Elec. Steel & Metals, Welland, Ont.

PUMPS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, KEROSENE, OIL, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, LUBRICANT, OIL, WATER
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS — ROTARY
General Combustion Co., Ltd., Montreal, Que.

PUMP LEATHERS
Graton & Knight Mfg. Co., Worcester.

PUNCHES AND DIES
Atkins & Co., Ltd., Wm., Sheffield, Eng.
E. W. Bliss Co, Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Can.
Can. Blower & Forge Co., Kitchener, Ont.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Gardner & Son, Robert, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Marshall, Son & Blunney, Toronto.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHES, POWER
John Bertram & Sons Co., Dundas, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd, Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co, Buffalo, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams, Ltd., Edinburgh, Scotland.
Bertrams & Sons, John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton, Ont.
Garlock-Walker Mach'y. Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHES, HAND
Niles-Bement-Pond Co., New York.

PYROMETERS
Bristol Co., Waterbury, Conn.
Shore Instrument & Mfg. Co., New York.
Taylor Instrument Co., Rochester, N.Y.

QUARTERING MACHINES
Bertram & Sons, John, Dundas, Ont.
Niles-Bement-Pond Co., New York.

RAIL BENDERS
Algoma Steel Corp., Sault Ste. Marie, O.

RAILROAD TOOLS
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

RASPS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

RAWHIDE PINIONS (See Gears)

REAMERS
Butterfield & Co., Inc., Rock Island, Que.

REAMERS, ADJUSTABLE
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.
J. A. M. Taylor, 318 Stair Bldg., Toronto
Wells Bros. of Can., Galt, Ont

REAMERS, BRIDGE, EXPANDING AND HIGH SPEED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Aikenhead Hardware Co., Toronto.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Gisholt Machine Co., Madison, Wis.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., J., Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Samuel Osborne, Ltd., Montreal, P.Q.
Strelinger, Chas. A. Co., Windsor, Ont
Wilt Twist Drill Co., Walkerville, Ont

REAMERS, STEEL TAPER AND SELF-FEEDING
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, CHUCKING
Ackworthie Ltd., J., Birmingham, Eng.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. of Canada, Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, HAND
Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, PIN
Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Morrow Screw & Nut Co., John, Ingersoll.
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMER FLUTING MACHINES
Garvin Machine Co., New York.

REAMING MACHINES, PNEUMATIC
Cleveland Pneumatic Co. of Can., Toronto
Garlock-Walker Machinery Co Toronto.
Holden Co., Ltd., Montreal, Que.

RECORDING INTRUMENTS
Bristol Co., Waterbury, Conn.
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Rochester, N.Y.

REELS, WIRE AND TEXTILE MFG.
American Pulley Co., Philadelphia, Pa.

REGULATORS, AUTOMATIC
Electric Steels & Metals, Ltd., Welland.

REGULATORS, PRESSURE, TEMPERATURE
Can. Fairbanks-Morse Co., Montreal
Taylor Instrument Co., Rochester, N.Y.

REPAIR WORK — SAWS
Atkins & Co., E. C., Hamilton, Ont.

REPAIR WORK, ALL KINDS
Elec. Steel & Metals, Welland, Ont.

RIVETS.
Aikenhead Hardware Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque.
Rice, Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.

RIVETERS, PNEUMATIC, HYDRAULIC, HAMMER, COMPRESSION
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co. Chicago.
Niles-Bement-Pond Co., New York

RIVETING MACHINES, ELASTIC, ROTARY BLOW
High-Speed Hammer Co., Rochester.
Petrie, Ltd., H. W., Toronto.
B. Shuster Co., New Haven, Conn.
Strelinger Co., C. A., Windsor, Ont.

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Holden Co., Ltd. Montreal, Que.

ROAD-MAKING MACHINERY
G. F. Foss Mchy & Sply. Co., Montreal.

RODS, PURE NICKEL, MONEL METAL, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville.

ROLLER CHAINS
Can. Link-Belt Co., Toronto
Jones & Glassco, Montreal.
Lyman Tube & Supply Co. Montreal, Que
Renold of Canada Ltd., Montreal.

ROLLS, BENDING, STRAIGHTENING
John Bertram & Sons Co., Dundas.
Brown, Boggs Co., Ltd. Hamilton.
Can. Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford
Garlock-Walker Machinery Co. Toronto
Niles-Bement-Pond Co. New York
Petrie Ltd., H. W. Toronto.
Toledo Machine & Tool Co., Toledo, O.

ROLLS CRUSHING
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.

ROLLS AND TABLES
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Elec. Steel & Metals, Welland, Ont.

ROOFING
H. H. Robertson, Ltd., Sarnia, Ont

ROPE, GALX, MONEL METAL, BRONZE, TILLER AND SASH CORD
Can. Driver-Harris Co., Ltd., Walkerville

ROLLING MACHINES, SHEET METAL
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLING MILL MACHINERY
Dom. Steel Products Co., Ltd., Brantford
Mesta Machine Co., Pittsburgh, Pa.

ROLL LATHES
Mesta Machine Co., Pittsburgh, Pa.

ROLLS, BENDING, STRAIGHTENING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLS, CRUSHING
Can. Link-Belt Co., Toronto.

ROOF COOLERS
Electric Steels & Metals, Ltd., Welland

RUBBER MILL DRIVES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford
Can. Link-Belt Co., Toronto.

RUBBER MILL MACHINERY
Bertrams Ltd., Edinburgh, Scotland.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford

RUBBER MOULDS & CORES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

RUBBER PRODUCTS, MECHANICAL
Dunlop Tire & Rubber Goods Co., Ltd., Montreal.

RUBBING BRICKS
Dominion Abrasive Co., Mimico, Ont.

RULES
Brown & Sharpe Mfg. Co., Providence.
James Chesterman & Co., Ltd., Sheffield.
Rice, Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N.Y.

SAW MILL CONVEYORS
Can. Link-Belt Co., Toronto.
Petrie, Ltd., H. W., Toronto.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.

SAND MIXING MACHINERY
Frost Mfg. Co., Chicago, Ill.

SANITARY DRINKING FOUNTAINS
Sanitary Drinking Fountain Co., Haydenville.

SANDING MACHINES
Canada Machinery Corp., Galt.

SAW MILL MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt.
Robert Gardner & Son, Montreal.
Curtis Pneumatic Mach'y Co., St. Louis
Hamilton Co., Ltd., Wm., Peterborough, Ont.
A. R. Williams Machy. Co., Toronto
Williams Mchy Co., A. R., Toronto, Ont.

SASH SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

SAWS FOR EVERY USE
Atkins & Co., E. C., Hamilton, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., E. C. Hamilton, Ont.
Cochrane-Bly Co., Rochester, N.Y., U.S.A.
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Marshal, Son & Bunney, Toronto
Simonds Mfg. Co., Fitchburgh, Mass.
Tabor Mfg. Co., Philadelphia, Pa

SAWS, HACK (See Hack Saws

SAW GUARDS
Ackworthie Ltd., J., Birmingham, Eng.
Atkins & Co., E. C., Hamilton, Ont
Clemson Bros. Inc., Hamilton, Ont.

SAWING MACHINES, METAL
Herbert, Ltd., Allred, Toronto, Ont.

SAWING MACHINES, CIRCULAR, FOR COLD METAL
Cochrane-Bly Co., Rochester, N.Y., U.S.A.

SAWS, METAL, HACK AND BAND
Atkins & Co., E. C., Hamilton, Ont
Clemson Bros. Inc., Hamilton, Ont.

SAWS, SILVER STEEL
E. C. Atkins & Co., Inc., Indianapolis

SAW SHARPENERS
Cochrane-Bly Co., Rochester, N.Y., U.S.A.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Can., Galt, Ont.

SAWS, SLITTING
J. A. M. Taylor, Stair Bldg., Toronto
Atkins & Co., E. C., Hamilton, Ont.

SAWS — HIGH-SPEED FRICTION
Atkins & Co., E. C., Hamilton, Ont.

SAWS — PATTERN SHOP
Atkins & Co., E. C., Hamilton, Ont.

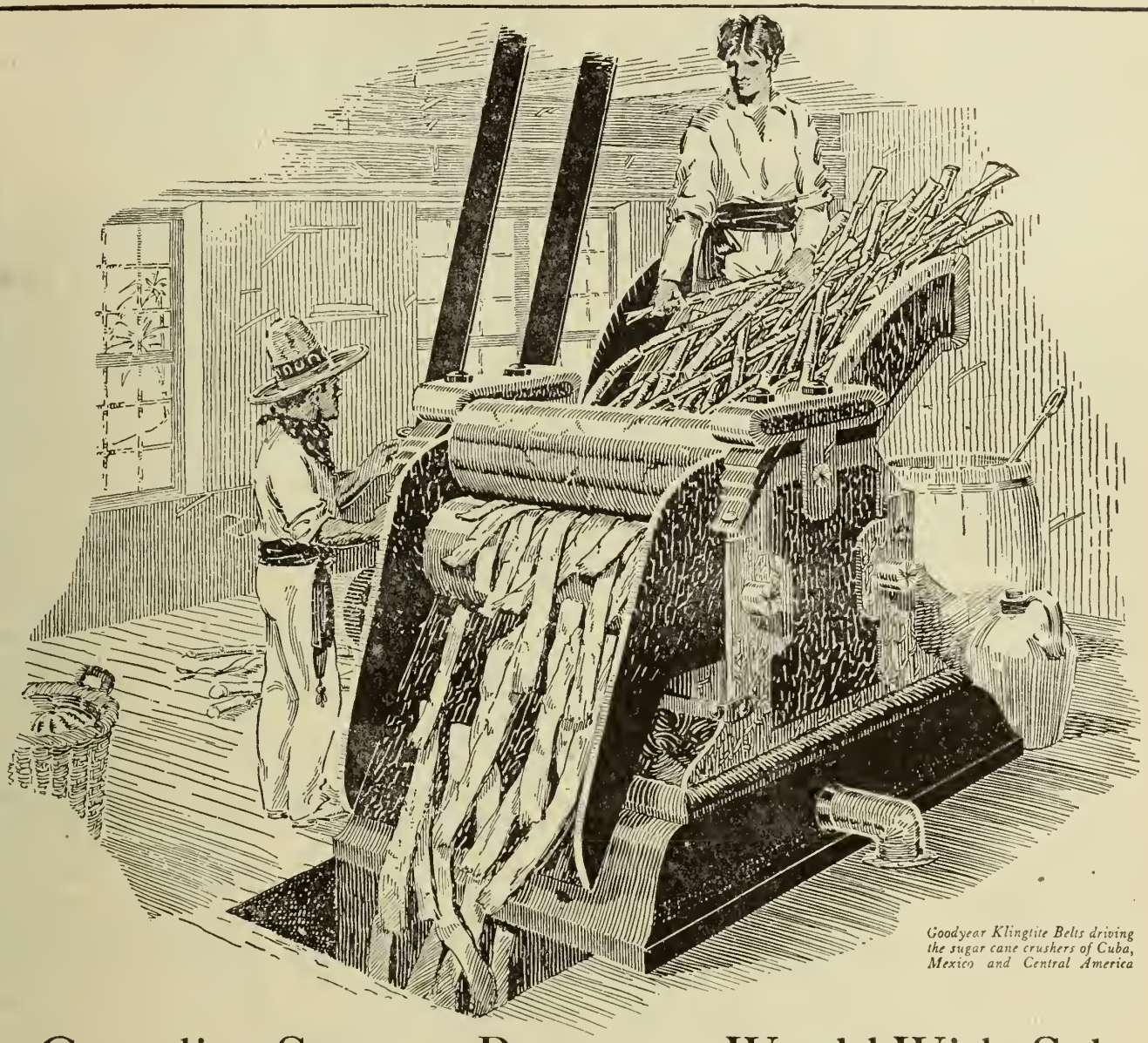
SAWS — SWING
Atkins & Co., E. C., Hamilton, Ont

SCLEROSCOPES
Shore Instrument & Mfg. Co., New York.

SCREENING MACHINERY
Can. Link-Belt Co., Toronto.

SCREW EXTRACTORS
Cleveland Twist Drill Co., Cleveland

SCREW MACHINES, HAND, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Ltd., Toronto
Parrin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
Herbert, Ltd., Alfred, Toronto, Ont.
A. B. Jardine & Co., Hespeler.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Varney & Swasey Co., Cleveland, O.
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Galt Machine Screw Co., Galt.
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Rice Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.

SCREW COLLARS
Galt Machine Screw Co., Ltd., Galt, Ont.
John Morrow Screw & Nut Co., Ingersoll.

SCREW MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence, R.I.
Herbert, Ltd., Alfred, Toronto, Ont.

SCREW PLATES
Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto.
J. A. M. Taylor, Stair Bldg., Toronto.
Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton.

SCREWS, SAFETY SET
Galt Machine Screw Co., Ltd., Galt, Ont.

SCREW SLOTTERS
Butterfield & Co., Inc., Rock Island, Que.
Garvin Machine Co., New York.
National Acme Co., Cleveland, O.
Pratt & Whitney Co., Dundas, Ont.

SELF-OPENING DIES
See Dies.

SET SCREWS, SAFETY
Aikenhead Hardware Co., Toronto.
Bristol Co., Waterbury, Conn.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wilkinson & Kompass, Hamilton.

SHANKS, STRAIGHT AND TAPER
Jacobs Mfg. Co., Hartford, Conn.

SHAPERS
John Bertram & Sons Co., Dundas.
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Cochrane-Bly Co., Rochester, N.Y., U.S.A.
Geo. F. Foss Machy. & Sply. Co., Montreal
Robt. Gardner & Son, Montreal.
Garlock-Walker Mach'y. Co., Toronto.
Herbert, Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
Standard Equipment & Tool Wks., Montreal.
Walcott Lathe Co., Jackson, Mich.
Williams Mchy Co., A. R., Toronto, Ont.

SHAPERS, GEAR
Fellows Gear & Shaper Co., Springfield, V.

SHAFTING
Algoma Steel Corp., Sault Ste. Marie, O.
Can. Fairbanks-Morse Co., Montreal.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glasco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

SHARPENING STONES
Norton Co. of Canada, Ltd., Hamilton, Ont.
Norton Co, Worcester, Mass.
Rice, Lewis & Son, Toronto.

SHEARING MACHINES, ANGLE IRON, BAR AND GATE
John Bertram & Sons Co., Dundas.
Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

SHEARS, POWER
John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Strelinger, Chas. A. Co., Windsor, Ont.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co., A. R., Toronto, Ont.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio

SHEARS, PLATE CUTTING, SLITTING
Dom. Steel Products Co., Ltd., Brantford.

SHEARS, SPLITTING
Dom. Steel Products Co., Ltd., Brantford.

SHEARS, IRREGULAR AND CIRCLE CUTTING
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEARS, SQUARING
Brown, Boggs & Co., Hamilton, Ont.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING MACHINERY
Herbert, Ltd., Alfred, Toronto, Ont.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING TOOLS
Baird Machine Co., Bridgeport, Conn.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Inc., Buffalo, N.Y.
Strelinger, Chas. A. Co., Windsor, Ont.

SHEETS, CRUCIBLE, CAST
British Smelting & Refining Co., Ltd., Montreal, Que.

SHEETS, BLACK AUTO AND GALVANIZED
Peckovers, Ltd., Toronto, Ont.

SHEETS, NICKEL, RESIST, ALLOY
Can. Driver-Harris Co., Ltd., Walkerville.

SHELVING, STEEL
Dennis Wire & Iron Works, London.

SHIPYARD MACHINERY, SHOP FURNITURE
Dennis Wire & Iron Works, London.

SIDE TOOLS
Armstrong Bros. Tool Co., Chicago.
J. H. Williams & Co., Brooklyn, N.Y.

SILENT CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glasco, Montreal.
Renold of Canada Ltd., Montreal.

SLEDGES
Aikenhead Hardware Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

SLINGS, CHAINS
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

SLOTTERS
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Herbert, Ltd., Alfred, Toronto, Ont.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.

SMOKESTACKS
William Hamilton Co., Peterboro, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

SNIPS, TINNERS AND SHEET METAL WORKERS
Kearney & Trecker Co., Milwaukee, Wis.
J. Morrow Screw & Nut Co., Ingersoll, Ont.

SOCKETS
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

SOIL PIPE FITTINGS, CAST IRON
Katie Foundry, Galt, Ont.

SOLDERING IRONS
Aikenhead Hardware Co., Toronto, Ont.
Brown, Boggs & Co., Hamilton, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

SOLDER
British Smelting & Refining Co., Ltd., Montreal, Que.
Aikenhead Hardware Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Hoyt Metal Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.

SPELTER
British Smelting & Refining Co., Ltd., Montreal, Que.

SPEED REDUCING GEARS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glasco, Montreal.

SPRINGS, MACHINERY
Barnes, Wallace Co., Bristol, Conn.
Can. Steel Foundries, Ltd., Montreal.
Cleveland Wire Spring Co., Cleveland.
Dunbar Bros. Co., Bristol, Conn.
Garlock-Walker Machinery Co., Toronto

SPECIAL MACHINERY
Baird Machine Co., Bridgeport, Conn.
Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada.
Brown Engineering Corp., Toronto, Ont
Dom. Steel Products Co., Ltd., Brantford
Ford-Smith Machine Co., Hamilton, Ont
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Globe Engineering Co. Ltd., Hamilton.
Hamilton Co., Ltd., Wm., Peterborough
A. B. Jardine & Co., Hespeler, Ont.
Katie Foundry, Galt, Ont.
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
National-Acme Co., Cleveland, Ohio.
Niagara Machine Co., Pittsburgh, Pa.
Stoll Co., D. H., Buffalo, N.Y.
Victoria Foundry Co., Ottawa, Ont.
William R. Perrin, Ltd., Toronto.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

SPECIAL TOOLS, MACHINERY
Crescent Machine Co., Ltd., Montreal, Que.
McClean Machine & Tool Co., Ltd., Hamilton, Ont.

SPOT FACERS, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

SPRING COILING AND WINDING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.

SPRING MAKING MACHINERY (AUTOMATIC)
Baird Machine Co., Bridgeport, Conn.

SPRINGS, SPIRAL, TOOL
The Dunbar Bros. Co., Bristol, Conn.

SPRINGS STEEL
Barnes Co., Wallace, Bristol, Conn.

SPROCKETS, COMPENSATING
Morse Chain Co., Ithaca, New York.

SPROCKETS, SPRING
Morse Chain Co., Ithaca, New York.

SPROCKETS, CHAIN
Can Link-Belt Co., Toronto, Ont.
Jones & Glasco, Montreal.
Lyman Tube & Supply Co., Montreal, Que
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia
Renold of Canada Ltd., Montreal.

SPRINGS FOR TOYS AND ELECTRIC DEVICES
The Dunbar Bros. Co., Bristol, Conn.

SPROCKET WHEELS, CAST
Can. Link Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

SANDERS
Oliver Mach. Co., Grand Rapids, Mich.

SAW BENCHES
Oliver Mach. Co., Grand Rapids, Mich.

SAW GUARDS
Oliver Mach. Co., Grand Rapids, Mich.

SAWING MACHINES
Herbert Ltd., Alfred, Toronto, Ont.

SAWS SWING
Oliver Mach. Co., Grand Rapids, Mich.

SMALL TOOLS
Herbert Ltd., Alfred, Toronto, Ont.

STAYBOLT TOPS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

STAIRS, IRON
Canada Wire & Iron Goods Co., Hamilton, Ont.

STAMPINGS, SHEET BRASS, COPPER, ALUMINUM AND STEEL
Dom. Forge & Stamping Co., Walkerville
Globe Engineering Co., Hamilton, Ont.

STAMPING MACHINERY
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs, & Co., Hamilton, Can.
Canada Machinery Corp., Galt, Ont.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

STEAM APPLIANCES
Darling Bros., Ltd., Montreal, Quebec.

STEAM SEPARATORS AND TRAPS
Can. Fairbanks-Morse Co., Montreal.

STEAM TURBINES
General Combustion Co., Ltd., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

STEEL BALLS
See Balls Steel.

STEEL, CRUCIBLE TOOL
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Illingworth Steel Co., John. New York
Marshall, Son & Bunney, Toronto.

STEEL, CARBON, FERRO-TUNGSTEN
Armstrong, Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng
Firth & Sons, Thos., Montreal, Que
Latrobe Electric Steel Co., Latrobe, Pa
Lincoln Electric Co. of Canada, Ltd Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Peckovers, Ltd., Toronto, Ont.
Samuel Osborne (Can.), Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh

STEEL, CHROME MOLYBDENUM
United Alloy Steel Corp., Canton, Ohio.

STEEL CHROME VANADIUM
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm. Sheffield, Eng
Marshall, Son & Bunney, Toronto
United Alloy Steel Corp., Canton, Ohio.

STEEL CHROME NICKEL
Firth & Sons, Ltd., Thos., Montreal,
Lyman Tube & Supply Co., Ltd., Montreal
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng
Marshall, Son & Bunney, Toronto
United Alloy Steel Corp., Canton, Ohio.

STEEL CASTINGS
Can. Elec. Steel Casting Co., Aurora, Ont
Davidson Mfg. Co., Ltd., Montreal, Que.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Dom. Iron & Steel, Sydney, N.S.
Kennedy & Sons, Wm., Owen Sound
Electric Steel & Metals Co., Welland.
Nova Scotia Steel & Coal Co., Windsor
Swedish Crucible Steel Co., Windsor.

STEEL, COLD DRAWN
United Alloy Steel Corp., Canton, Ohio.

STEEL, COLD ROLLED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Drawn Steel Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

STEEL, ELECTRIC FURNACE
United Alloy Steel Corp., Canton, Ohio.

STEEL FJAB
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.

STEEL, NICKEL
Atkins & Co., Ltd., Wm., Sheffield, Eng
Marshall, Son & Bunney, Toronto.
United Alloy Steel Corp., Canton, Ohio.

STEEL, HIGH SPEED
Armstrong-Whitworth of Can., Montreal
Wm. Atkins & Co., Sheffield, Eng.
Can. Fairbanks-Morse Co., Montreal
Deloro Smelting & Refining Co., Ltd Toronto, Ont.
H. A. Drury Co., Ltd., Montreal.
Firth & Sons, Thos., Montreal, Que.
Illingworth Steel Co., J., New York.
Latrobe Electric Steel Co., Latrobe, Pa
Marshall, Son & Bunney, Toronto, Ont
Osborne, Samuel, Montreal, P.Q.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, OPEN HEARTH
Illingworth Steel Co. John. New York
United Alloy Steel Corp., Canton, Ohio.

STEEL PLATES
Dominion Foundries & Steel Ltd., Hamilton, Ont.

STEEL PRODUCTS AND MACHINERY
Dom. Steel Products Co., Ltd., Brantford

STEEL, ROCK DRILL
Armstrong, Whitworth of Canada, Montreal, Que.
Lincoln Electric Co. of Canada, Ltd. Toronto, Ont.

STEEL, SPECIAL ANALYSIS
United Alloy Steel Corp., Canton, Ohio.

STEEL, SPRING AND REINFORCING
Peckovers, Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie
MacKinnon Steel Co., Sherbrooke, Que.
Peckovers, Ltd., Toronto, Ont.

STEEL, TOOL
Armstrong, Whitworth of Can., Montreal
Atkins & Co., Wm., Sheffield, Eng.
Can. Fairbanks-Morse Co., Montreal
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Co., H. A., Montreal, Que.
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
Firth & Sons, Thos., Montreal, Que
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont.
Latrobe Electric Steel Co., Latrobe, Pa.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL TUBING
Tube Co. of Canada, Ltd., Toronto, Ont.

STEEL, VANADIUM
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Armstrong, Whitworth of Can., Montreal
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Drury, H. A., Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Vanadium-Alloys Steel Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

"STELLITE"
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.

STOCK RACKS FOR BARS, PIPING, ETC.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

STOCKS AND DIES
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.

STOCKS, PIPE
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros., Co., of Canada, Galt, Ont.

STONES, COMMUTATORS
Lyman Tube & Supply Co., Ltd., Montreal

STRAIGHTENING MACHINERY
Baird Machinery Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland.

STRAND
Dom. Steel Products Co., Ltd., Brantford.
Page Steel & Wire Co., Adrian, Mich.

SURFACE PLATES
Brown & Sharpe Mfg. Co., Providence, R.I.

STRUCTURAL STEEL WORKS
William Hamilton Co., Peterboro, Ont.

SWITCHBOARDS
Can. Steel Foundries, Ltd., Montreal.

SWITCHES, RAILWAY
Northern Electric Co., Ltd., Montreal Que

BEAVER BRAND METALS

Made in Canada

Recognized as the Standard of Quality

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Sheets, Rolls, Plates and Rods

Brown's Copper and Brass Rolling Mills, Ltd.

NEW TORONTO, ONTARIO, CANADA

If interested tear out this page and place with letters to be answered.

TABLES, DRAWING
Economy Drawing Table Co., Adrian, Mich.

TAPPING MACHINES (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

TANKS, AIR, EXPANSION
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, GASOLINE, KEROSENE AND OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville.
MacKinnon Steel Co., Sherbrooke, Que.
Marshall, Son & Bunney, Toronto.

TANKS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, PNEUMATIC AND CLOSET
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

TANKS, STEEL, WATER PRESSURE
Bowser Co., Ltd., S. F., Toronto, Ont.
Dominion Bridge Co., Montreal, Quebec.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd, Toronto.

TANK WAGONS
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto.

TANKS, WELDED
Can. John Wood Mfg. Co., Ltd., Toronto
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

TANKS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que
Williams Hamilton Co., Peterboro, Ont.

TAPER PINS
Galt Machine Screw Co., Ltd., Galt, Ont.

TAPES, MEASURING
James Chesterman & Co., Ltd., Sheffield, Eng.
Rice Lewis & Son, Toronto, Ont.

TAPPING MACHINES AND ATTACHMENTS
Bertram, John & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garvin Machine Co., New York.
The Geometric Tool Co., New Haven.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit.
Niles-Bement-Pond Co., New York.
National-Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
L. S. Starrett Co., Athol, Mass.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

TAPS, ADJUSTABLE
Butterfield & Co., Rock Island, Que.
Geometric Tool Co., New Haven.
Ingersoll Mach. Co., Ingersoll, Ont.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Pilot Steel & Tool Co., Montreal, Que.
Victor Tool Co., Waynesboro, Pa.

TAPS, GUN, HAND, BOILER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE RELIEVED
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE SCREW
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, PIPE
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
Wells Bros. of Can., Galt, Ont.

TAPS, STAYBOLT, TAPPER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

TAPS, DIES AND WRENCHES
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Sply. Co., G. F., Montreal.
Geometric Tool Co., New Haven.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Morse Twist Drill & Mchy. Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Strelinger, Chas. A. Co., Windsor, Ont.
Taylor, J. A. M., 115 Stair Bldg., Toronto.
Wells Bros. of Canada, Galt, Ont.

TAP EXTRACTORS
Walton Co The, Hartford, Conn.

THERMOMETERS, INDUSTRIAL ENGRAVED TEMPERATURE AND PRESSURE
Taylor Instrument Co., Rochester, N.Y.

THERMOMETERS, RECORDING AND INDEX
Bristol Co., Waterbury, Conn., U.S.A.
Taylor Instrument Co., Rochester, N.Y.

TESTING INSTRUMENTS, METALLURGICAL
Shore Instrument & Mfg. Co., New York.

TENOVERS
Oliver Machy. Co., Grand Rapids, Mich.

TESTING LABORATORIES
Toronto Testing Laboratory, Toronto.

THREAD-CUTTING MACHINES
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Mach. Co., Ltd., Toronto
Geometric Tool Co., New Haven.
Jardine & Co., Ltd., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.
National Machy. Co., Tiffin, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.

THREADING TOOLS
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Greenfield.
Landis Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y

THREADING MACHINES FOR BOLTS, NUTS AND PIPES
Greenfield Tap & Die Corp., Greenfield
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.

THUMB SCREWS AND NUTS
See Screws.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

TIN—PIG AND BAR
British Smelting & Refining Co., Ltd. Montreal Que.
Hoyt Metal Co., Toronto, Ont.

TINSMITHS' TOOLS
Brown, Boggs & Co., Hamilton, Can.
Petrie, Ltd., H. W., Toronto.

TIRE BENDERS
Jardine & Co., Ltd., A. B., Hespeler.

TIRE SETTING MACHINES, HYDRAULIC
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Perrin, Ltd., William R., Toronto.

TOOL CASES
Rice Lewis & Son, Toronto, Ont.

TOOL HOLDERS
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago.
Cleveland Twist Drill Co., Cleveland.
Deloro Smelting & Refining Co., Ltd Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL MAKERS
Samuel Osborne (Can.), Ltd., Montreal

TOOL POSTS, LATHE
Armstrong Bros. Tool Co., Chicago.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL ROOM EQUIPMENT
Herbert Ltd., Alfred, Toronto, Ont.

TOOL ROOM PARTITIONS
Canada Wire & Iron Goods Co., Hamilton

TOOLS, BLACKSMITHS'
A. B. Jardine & Co., Ltd., Hespeler, Ont
Rice Lewis & Son Toronto, Ont.

TOOLS, ADJUSTABLE BORING
Petrie, Ltd., H. W., Toronto.

TOOLS, ELECTRIC
Ford-Smith Machine Co., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co. Chicago
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Machy. Co., A. R. Toronto.
U. S. Electrical Tool Co., Cincinnati, O

TOOLS, FORMING
Davidson Tool Mfg. Co., New York, N.Y
Deloro Smelting & Refining Co., Ltd Toronto, Ont.

TOOLS, LUMBERING
Thos. Pink & Co., Pembroke, Ont.

TOOLS, LATHE, PLANER, SLOTTER
Armstrong Bros. Tool Co., Chicago.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

TOOLS, SCREW MACHINE
Foster Machine Tool Co., Elkhart, Ind.

TOOLS, SHOP
Strelinger Co., C. A., Windsor, Ont.

TOOLS, SPECIAL
Crescent Machine Co., Ltd., Montreal, Que.
McClean Machine & Tool Co., Ltd., Hamilton, Ont.
McCrosky Tool Corp., Meadville, Pa., U. S. A.

TORCHES, BLOW
Int. Mach. & Supply Co., Ltd., Montreal

TORCHES, GASOLINE, KEROSENE AND ALCOHOL
Turner Brass Works, Sycamore, Ill.

TORCHES, STEEL
Armstrong, Whitworth of Can., Montreal.
Prest-O-Lite Co., Inc., Toronto, Ont.

TRACK SYSTEMS
Brown Hoisting Machinery Co., Cleveland, Ohio.
Morris Crane & Hoist Co., Herbert. Niagara Falls, Ont.
Northern Crane Works, Walkerville.

TRAM RAIL SYSTEMS (Overhead)
Brown Hoisting Machinery Co., Cleveland, Ohio.

TRAMWAYS, BRIDGE
Brown Hoisting Machinery Co., Cleveland, Ohio.

TRANSFORMERS
Can. General Electric Co., Toronto, Ont
MacGovern & Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal.

TRANSITS
Hughes, Owens Co., Ltd., Montreal, Que.

TRANSMISSION CHAIN
Lyman Tube & Supply Co., Ltd., Montreal
Morris Chain Co., Ithaca, New York.
Renold of Canada Ltd., Montreal.

TRANSMISSION MACHINERY
American Pulley Co., Philadelphia, Pa.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Hamilton Gear & Machine Co., Toronto.
Jones & Glasco, Montreal.
Kennedy & Sons, Wm., Owen Sound, Ont
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Renold of Canada Ltd., Montreal.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto.

TRANSMISSION ROPE
Jones & Glasco, Montreal, Que.
MacKinnon Steel Co., Ltd., Sherbrooke

TRANSMISSION TOWERS
Curtis Pneumatic Machy. Co., St. Louis
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que
Northern Crane Works, Walkerville
Tallman Brass & Metal Co., Hamilton

TROLLEYS
Brown Hoisting Machinery Co., Cleveland, Ohio.
Lyman Tube & Supply Co., Ltd., Montreal
Morris Crane & Hoist Co., Ltd., Herbert Niagara Falls, Ont.

TRUCKS, FACTORY, FREIGHT, ETC
Canada Machinery Corp., Galt, Ont.
Chapman Double Ball Bearing, Toronto
Cowan Truck Co., Holyoke, Mass.
MacKinnon Steel Co., Sherbrooke, Que.
Rice Lewis & Son, Toronto, Ont.

TRUCKS, ELECTRIC
Cowan Truck Co., Holyoke, Mass.

TRUCKS, FLOOR
Cowan Truck Co., Holyoke, Mass.

TRUCKS, HAND
Cowan Truck Co., Holyoke, Mass.

TRUCKS, LUMBER AND KILN
Swedish Steel & Importing Co., Montreal
Northern Crane Works, Walkerville.

TRUCKS, LIFT, ELEVATING & TRANSFER
Cowan Truck Co., Holyoke, Mass.

TUBES, BOILER
Lyman Tube & Supply Co. Montreal Q.

TUBING ELECTRIC WELDED OR OXYACETYLENE WELDED
Tube Co. of Can., Ltd., Toronto, Ont.

TUBE PROUCTS
Tube Co. of Can., Ltd., Toronto, Ont.

TUBING, SEAMLESS, BRASS AND COPPER
Lyman Tube & Supply Co., Montreal, Que
Standard Tube & Fence Co., Woodstock
Tallman Brass & Metal Co., Hamilton

TUBING, FLEXIBLE METALLIC
Lyman Tube & Supply Co., Montreal, Que

TUBING, SEAMLESS STEEL
Tube Co. of Can., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que

TUBING, WELDED STEEL
Lyman Tube & Supply Co., Montreal Que
Tube Co. of Can., Ltd., Toronto, Ont.

TURRET MACHINES, LATHES
Acme Mach. Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence.
Garlock-Walker Machinery Co., Toronto
Greenfield Tap & Die Corp., Greenfield
Oliver Mchy. Co., Grand Rapids, Mich
Pratt & Whitney, Hartford, Conn.
Petrie, Ltd., H. W., Toronto.
Stubbs Turret Mach. Co., Madison, Wis
Strelinger, Chas. A. Co., Windsor, Ont.
Warner & Swasey Co., The, Cleveland, O

TURBO GENERATOR UNITS
Garvin Machine Co., New York
Holden Co., Ltd., Montreal, Que.
MacGovern & Co., Montreal, Que.
Warner & Swasey, Cleveland, O.

TURNBUCKLES
Canada Fdrs. & Forg. Ltd., Welland
Morrow Screw & Nut Co., Ingersoll, Ont
Rice Lewis & Son, Toronto, Ont.

TURNTABLES
Can. Link-Belt Co., Toronto, Ont.
Dom. Bridge Co., Ltd., Montreal, P.Q
Elec. Steel & Metals, Welland, Ont.
Morris Crane & Hoist Co., Ltd., Herbert Niagara Falls, Ont.

TWIST DRILLS
Butterfield & Co., Inc., Rock Island, Que

UPSETTING AND BENDING MACHINERY
Bertram & Sons Co., John, Dundas.
Brown, Boggs Co., Ltd., Hamilton, Can.
Ford-Smith Machine Co., Hamilton, Ont
Garlock-Walker Machinery Co., Toronto.
Jardine & Co., A. B., Hespeler, Ont.
National Machy. Co., Tiffin, O.
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.

VACUUM PUMPS
Holden Co., Ltd., Montreal, Que.

VALVE LEATHERS
Graton & Knight Mfg. Co., Montreal

VALVES, MIXING
Crane, Ltd., Montreal, Que.

VALVES (IRON) STANDARD AND EXTRA HEAVY
Crane, Ltd., Montreal, Que.

VALVE GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

VALVES, HYDRAULIC
Metalwood Mfg. Co., Detroit, Mich.

VALVES, RUBBER PUMP
International Mach. Sply., Ltd., Montreal
Quaker City Rubber Co., Philadelphia

VENTILATORS
H. H. Robertson, Ltd., Sarnia, Ont.

VENTILATING APPARATUS
Brantford Oven & Rack Co., Brantford
Can. Blower & Forge Co., Kitchener, Ont
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
Williams Machy. Co., A. R., Toronto.

VISE STANDS, PORTABLE
Williams & Co., J. H., Brooklyn, N.Y

VISES, BENCH
Aikenhead Hardware Co., Toronto, Ont.
Foss Machy. & Sply. Co., G. F., Montreal.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Superior Machinery Co., London, Ont.

VISES, DRILL
Superior Machinery Co., London, Ont.

VISES, PIPE
Atkins & Co., Ltd., Wm., Sheffield, Eng
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y
Strelinger, Chas. A. Co., Windsor, Ont.

VISES, MILLING MACHINE
Brown & Sharpe Mfg. Co., Providence, R.I.
Superior Machinery Co., London, Ont

VISES, PLANER AND SHAPER
Aikenhead Hardware Co., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Superior Machinery Co., London, Ont.

VOLMETERS & AMMETERS
Northern Electric Co., Ltd., Montreal Que

WASHER MACHINES
National Machy. Co., Tiffin, Ohio.

WASHERS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes, Wallace, Co., Bristol, Conn.
Graton & Knight Mfg. Co., Worcester.
London Bolt & Hinge Wks., London, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

WASTE
Wilkinson & Kompass Hamilton, Ont.

WASTE CLEANER AND OIL RECLAIMER
Oakley Chemical Co., New York, N.Y.

WATER-INTAKE SCREENS
Can. Link-Belt Co., Toronto, Ont.

WATER TOWERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto.

WATER WHEELS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hamilton Co., Ltd., Wm., Peterborough

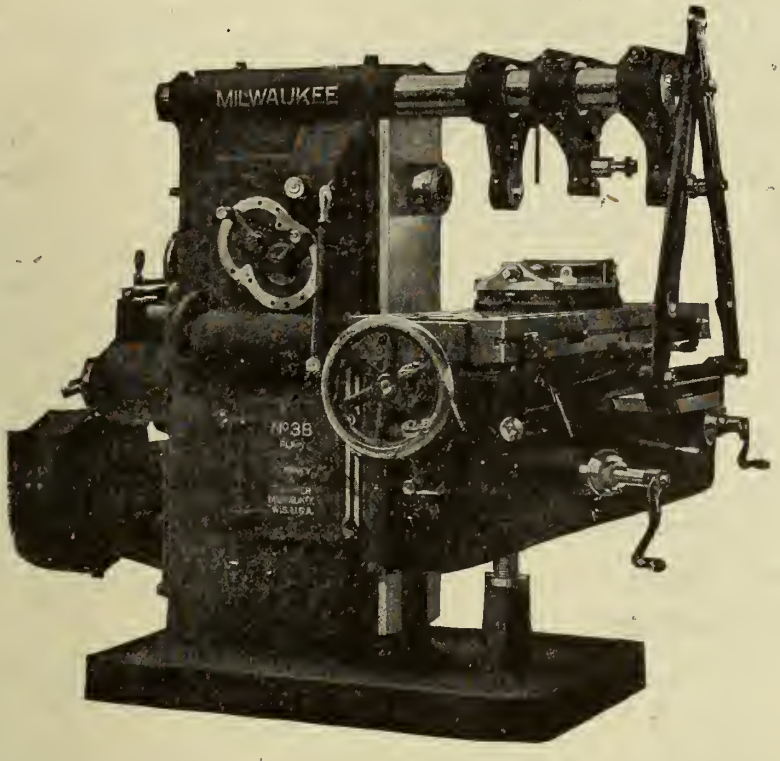
WELDED TANKS
Can. John Wood Co., Toronto, Ont.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

WELDERS, ELECTRIC ARC
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

WELDING, ELECTRIC, SPOT, BUTT, ETC.
McClean Machine & Tool Co., Ltd., Hamilton, Ont.
Tabor Mfg. Co., Philadelphia, Pa.

WELDING MASKS
Carter Welding Co., Ltd., Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.

Milwaukee Milling Machines



Design and Construction

Your Assurance of Excellent Milling Machine Quality

It is the correctness of design and construction that makes Milwaukee Milling Machines the fine piece of mechanism that they are. These machines are built to the closest limits and only the most advanced methods of precision are employed by expert craftsmen in their manufacture.

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The machines efficiently handle both light and heavy milling operations. Accuracy and rigidity are obtained through correct distribution of the metal to the various members of the machine. The column, table, saddle and knee are properly proportioned so that one corresponds with the other, forming a harmonious unit. This superior construction assures accuracy and rapid production at all times.

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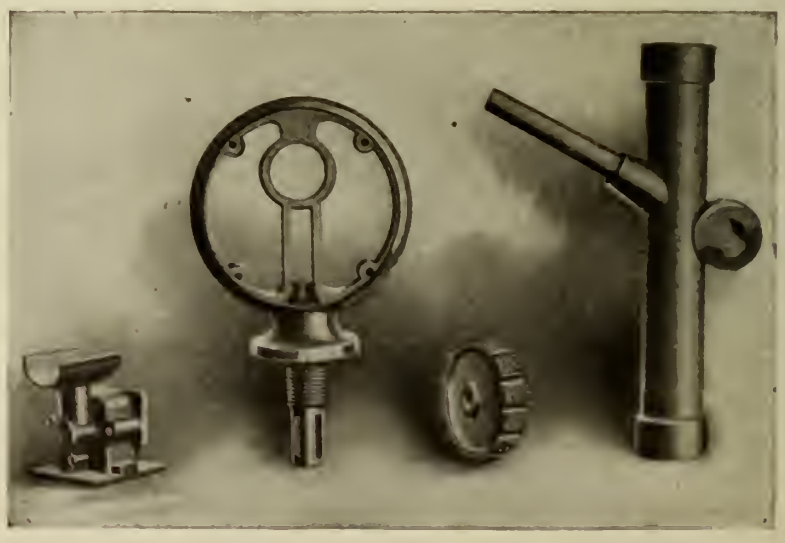
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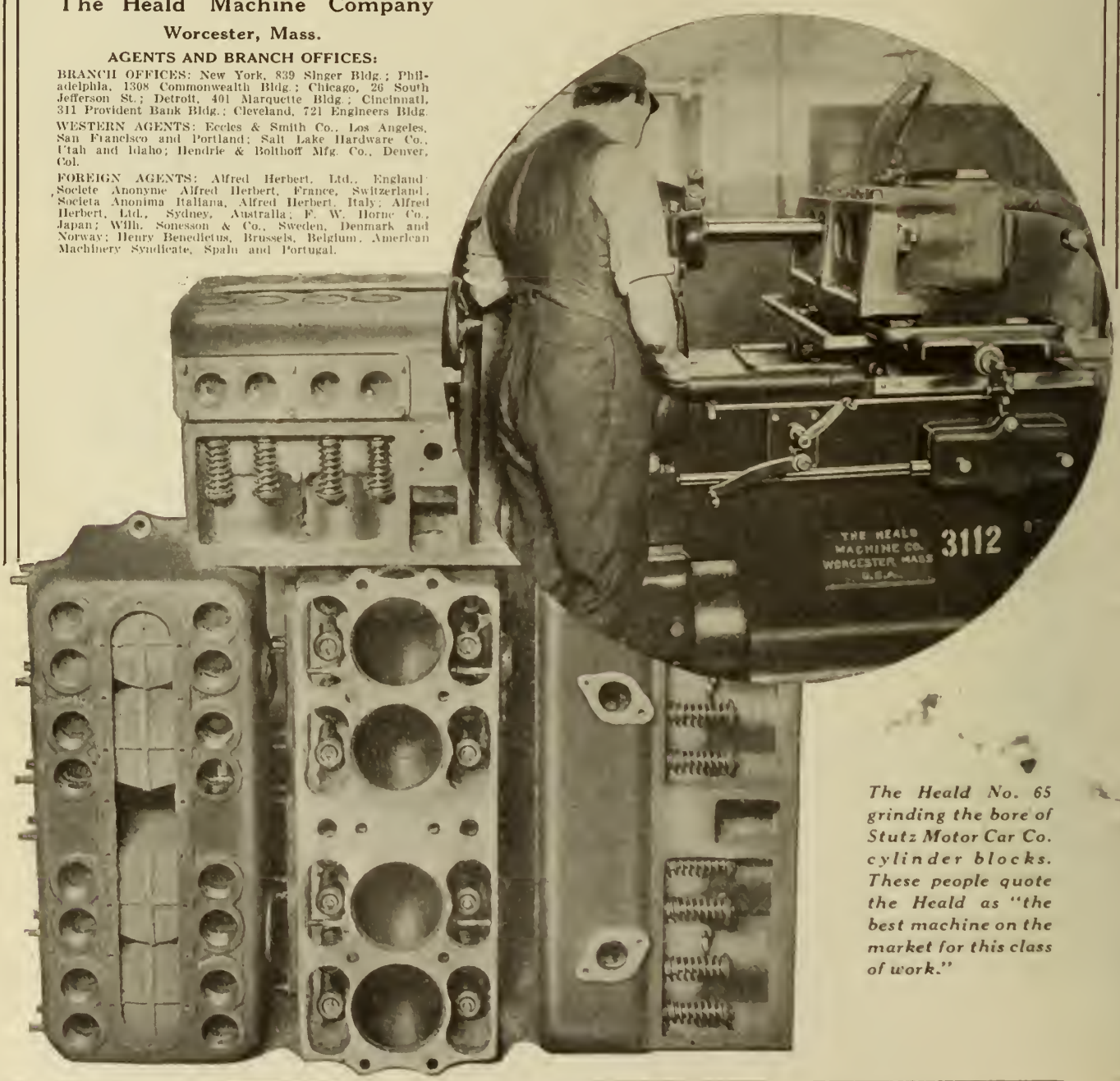
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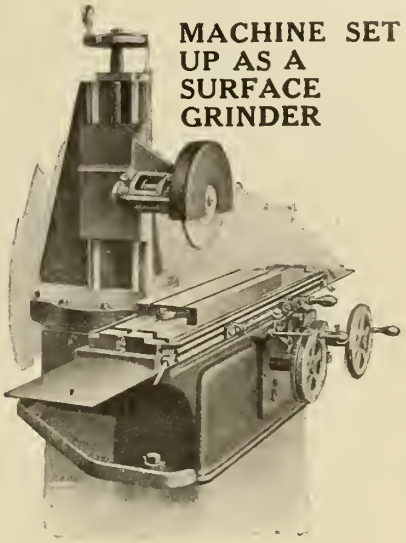
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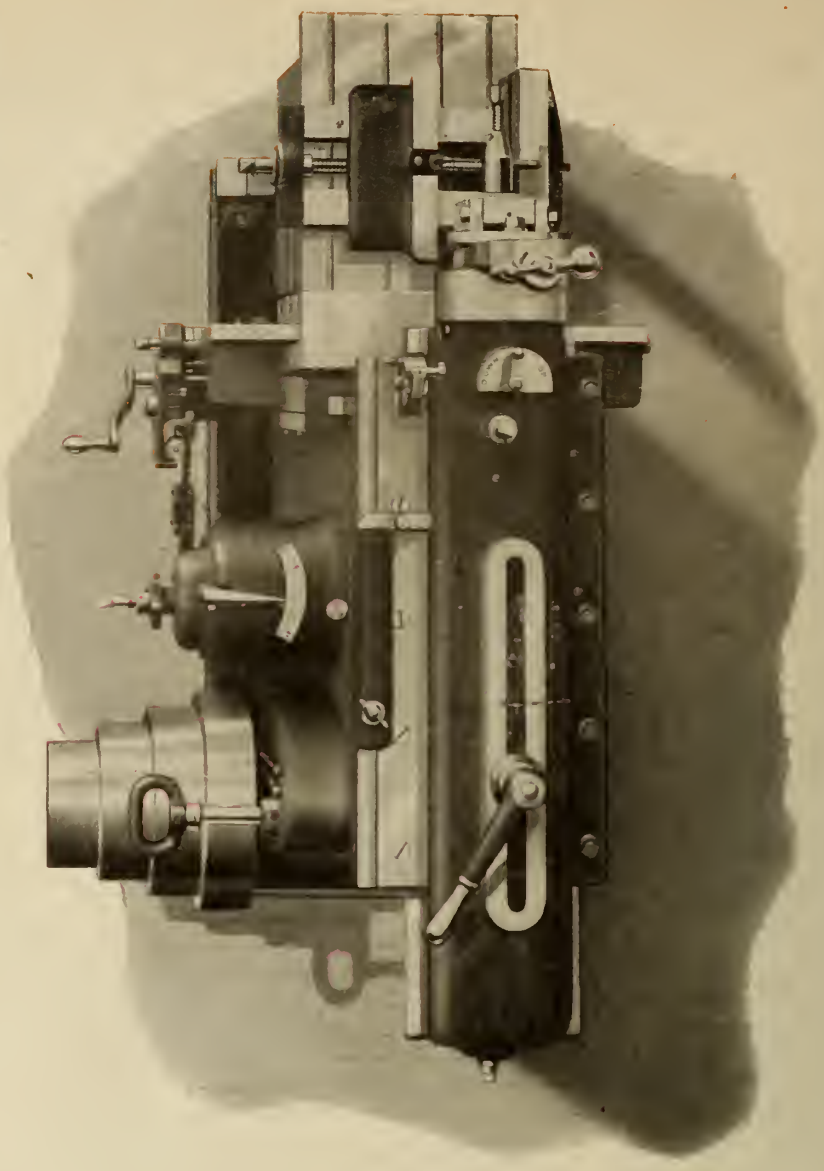
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Vol. XXIV., No. 25 Published by the MacLean Publishing Company, Limited, Toronto December 16, 1920 $4.00 a Year Subscription Price

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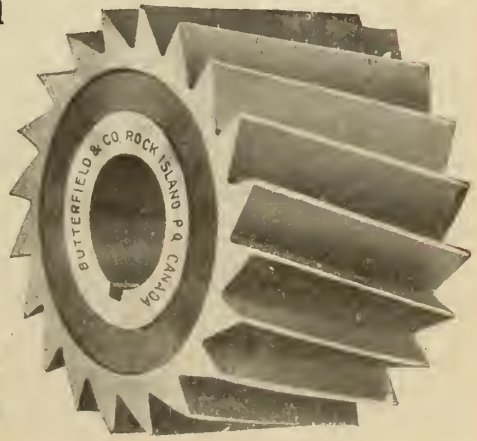
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MACHINE TOOLS

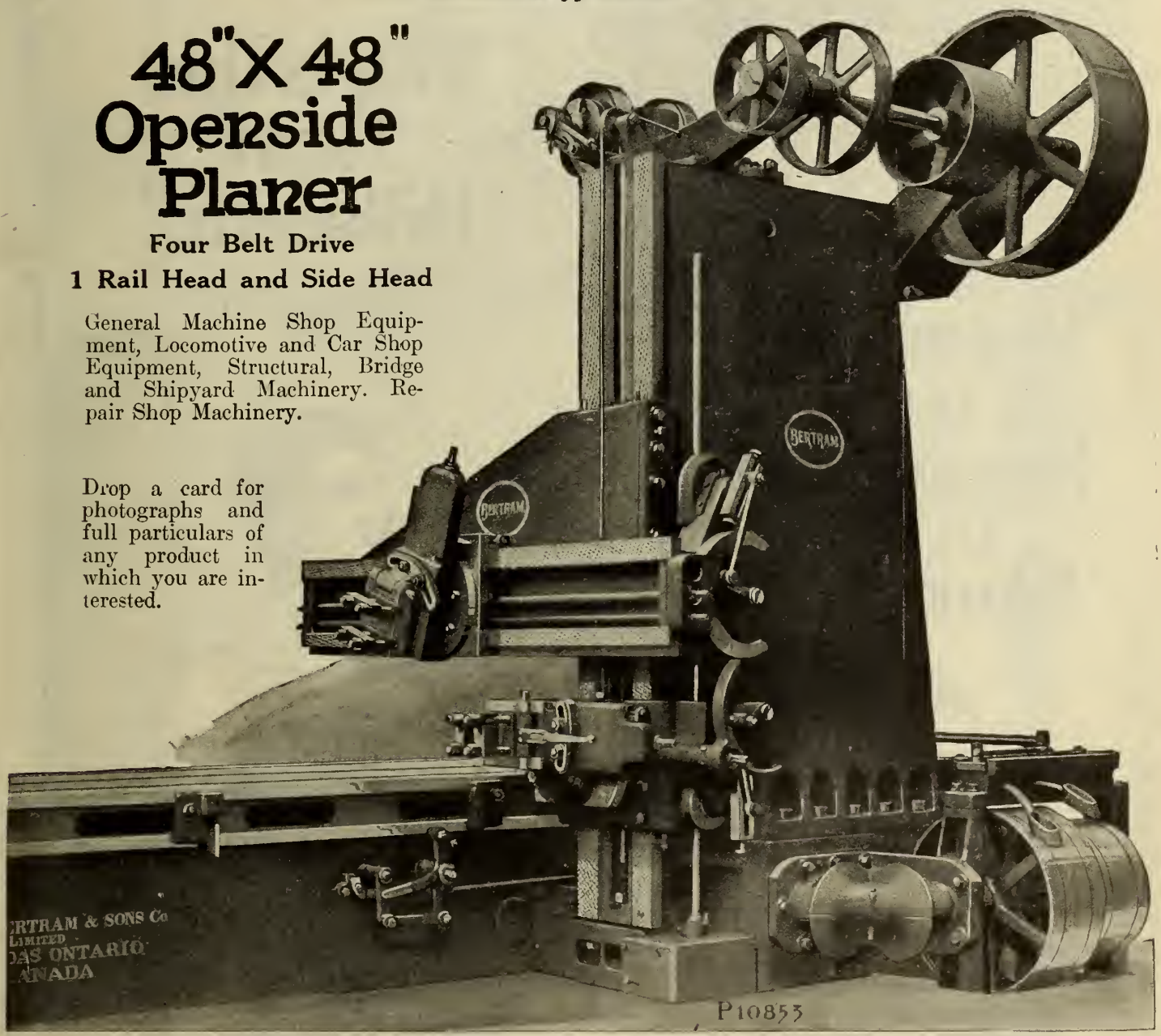
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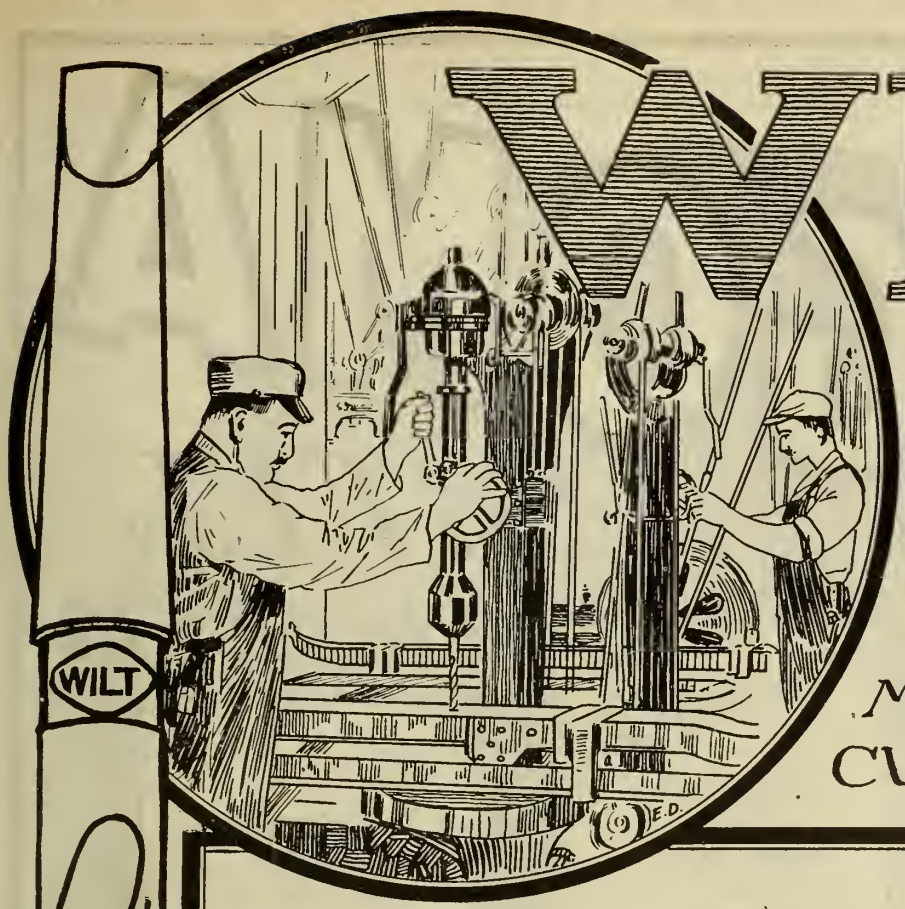
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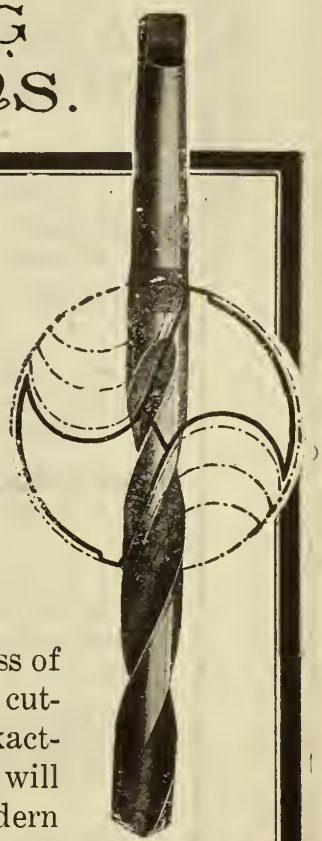
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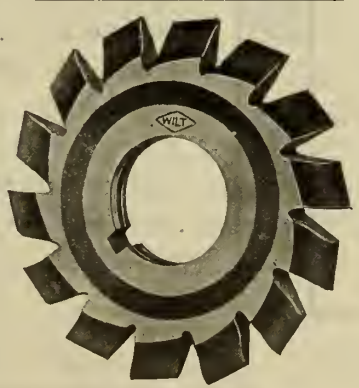
trade WILT mark

"Where there's a WILT— There's the Way."

Production Means Profit

Your profit lies in quantity production. Anything which will tend to increase your production merits your careful consideration.

The inherent strength and trueness of Wilt Tools permits unusually fast cutting. They are made with an exacting care which insures that they will stand up under the stress of modern cutting demands. A trial will convince you that Wilt Tools should be standard in your shop.



Made in Canada

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ALLOY STEELS

CHROME-VANADIUM

CHROME-NICKEL

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All of these steels are supplied in

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BILLETS
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FOUNDRY
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For the better convenience of customers who may find it necessary to secure rush shipments of particular items, we are keeping a large stock of all the various standard sections constantly on hand, and to this end extensive warehouse facilities are being prepared. Your enquiries and business will be appreciated.

May we have your next order?

Algoma Steel Corporation, Limited

SAULT STE. MARIE, ONTARIO, CANADA

Sales Offices: Montreal: 606 McGill Building. Toronto: Bank of Hamilton Building

Johansson ACCURACY

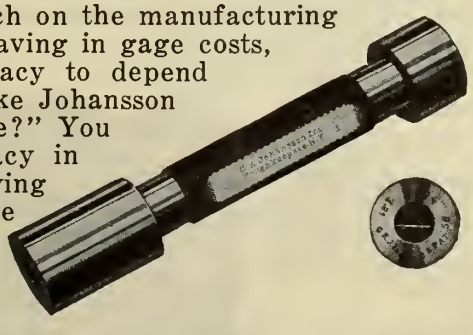
••HOW YOU CAN TRIPLE•• THE LIFE OF A PLUG GAGE

EVERY user of a Johansson reversible end Tolerance Plug Gage can prolong its life three-fold, greatly reducing gaging costs, by taking advantage of its well known dependable accuracy and superior wearing qualities in the following manner:

IN general practice, Tolerance Plug Gages are ordered to the same size as the limits on the blue print of the part to be gaged. Assume that you have a limit of .005″ on a hole, say from .745″ Go to 750″ No Go. If the gaging ends were made to these sizes, under ordinary circumstances the Go member would be discarded when both ends of the member (after reversing) were worn to .0002″ under size, in this instance to .7448″. Now this .0002″ is a very small part of the total limit of .005″, yet it plays a very large part in your gaging costs.

TESTS have proved that a ¾″ Johansson Go member will inspect approximately 3,000 holes in cast iron to the .0001″ wear of the gaging member. This gives 6,000 holes for each end of the Go member in question or a total of 12,000 holes by reversing. Suppose you permitted us to make the Go member of the Johansson Plug Gage larger than the specified blue print size, say, for example, one-tenth of the total limit or, in this instance, .0005″, making the size of the gaging members .7455″ Go and .750″ No Go. This 10% of the limit, over size, will reduce very little the production limits on the work, in fact, no more than is often allowed for inaccuracies on manufacturers' "own make" plug gages. Note, however, how greatly it increases the efficiency of the plug gage; from 12,000 holes inspected to 42,000 for each Go member before it is worn to .7448″, the size for discarding.

ONLY when the highest accuracy can be depended upon, as is the case with Johansson Plug Gages which are made by the same exclusive methods as used on the well known Johansson Standard Block Gages, is it wise to encroach on the manufacturing limits as described above. This saving in gage costs, when you have Johansson accuracy to depend upon, is the answer to "Why make Johansson Tolerance Plug Gages so accurate?" You can profitably utilize this accuracy in your own shop by thus employing Johansson reversible end Tolerance Plug Gages.



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Williams & Wilson, Ltd., MONTREAL, QUE.

Chas. A. Strelinger of Canada, Ltd. WINDSOR, ONT.

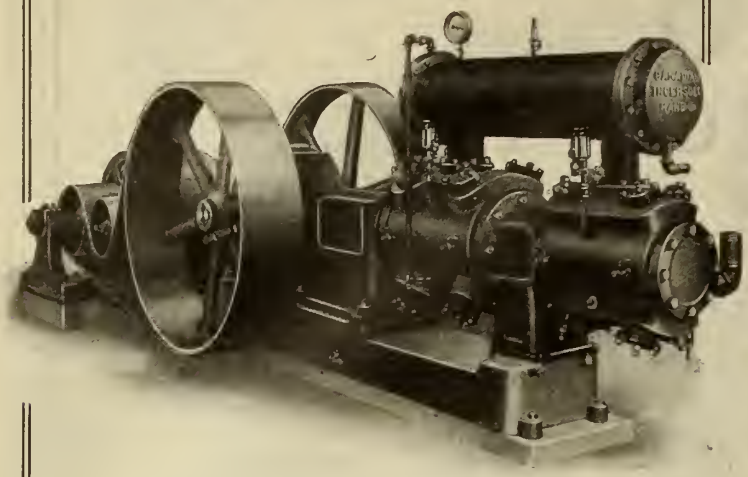
C·E·Johansson·Inc

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Compressors



Class EL-2 Power Driven, Two Stage, Straight-Line Compressor

THESE machines are of enclosed dust-proof construction, have automatic flood lubrication and silent leaf valves. They are built in one size for pressures of 50 to 100 lbs. and a capacity of 472 cu. ft. per minute.

They possess all the advantages of two stage compression with the simplicity and compactness of straight-line design. Equipped with a short belt drive attachment they form a simple, compact arrangement comparable only to the direct connected type in efficiency, economy, and floor space occupied.

Bulletin K-303

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"BOTH of these operations and half another — I'll show you later—completed in the time our old taps took to do one; that, I guess, is why we continue to use your Victor Collapsible Taps."

It was the often-heard story of time saved, of costs lowered, of all threads clean and smooth. And it was pleasant to hear.

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STEEL

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Works: WELLAND, ONT.



Manufacturers:

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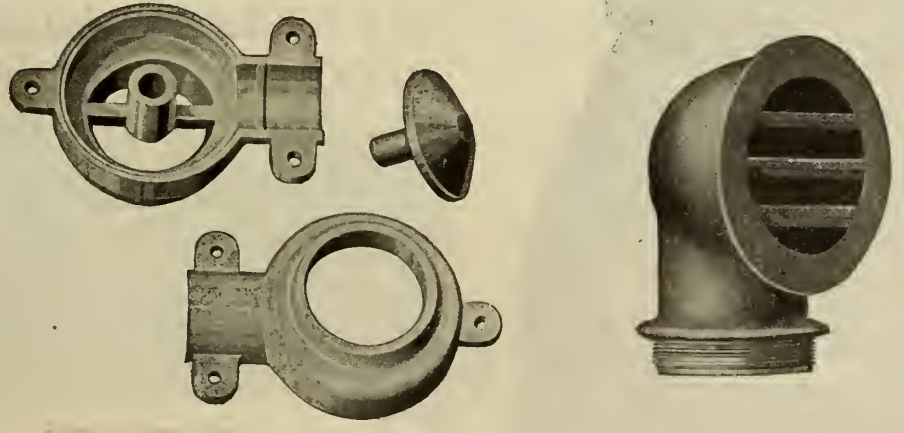
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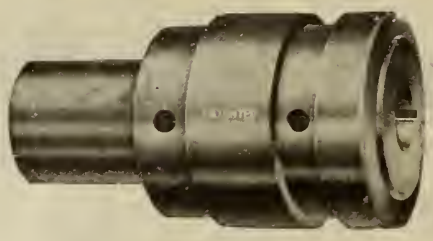
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you are anxious to put into your product every refinement which will add to its efficiency—which will make it serve your customer longer and more satisfactorily.

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Write for Our Yellow Catalog and Booklet "Clutches as Applied to Machine Building"

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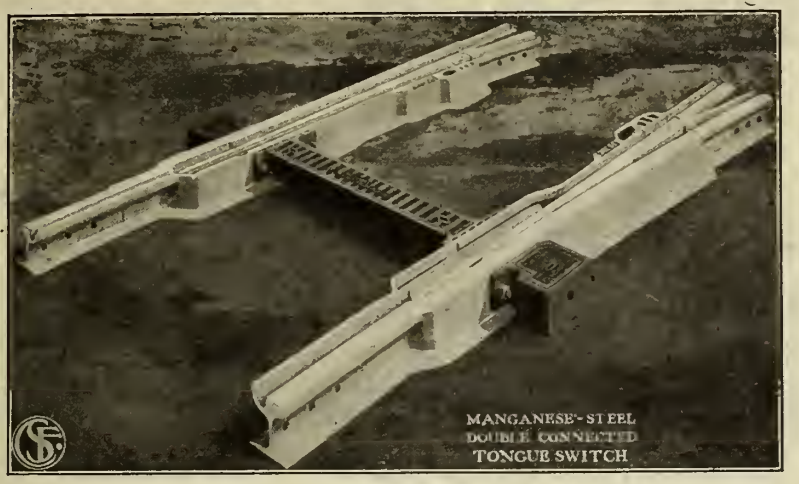
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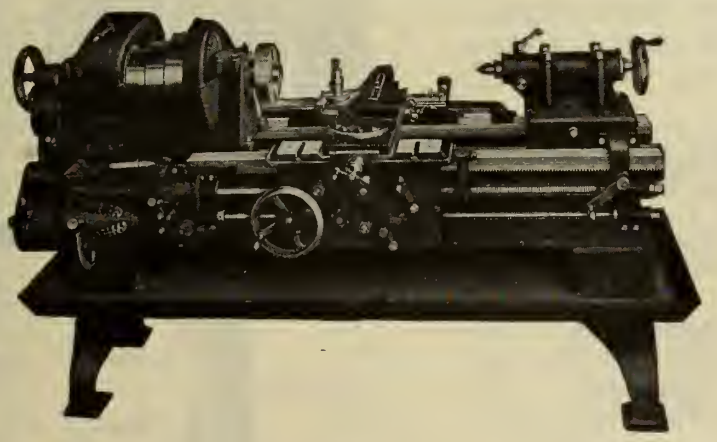
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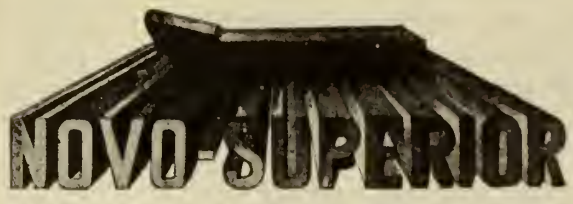
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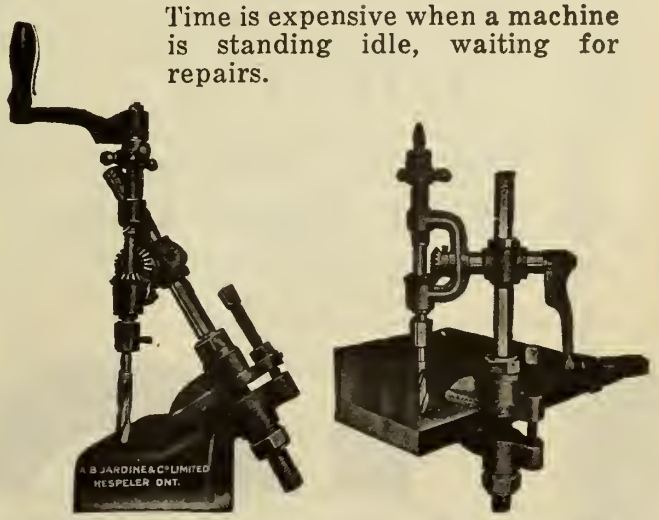
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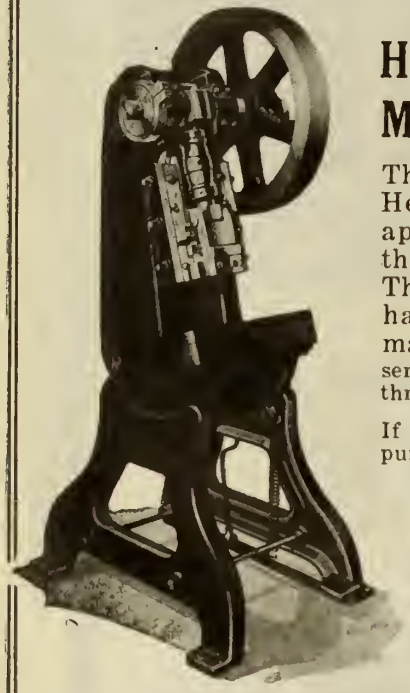
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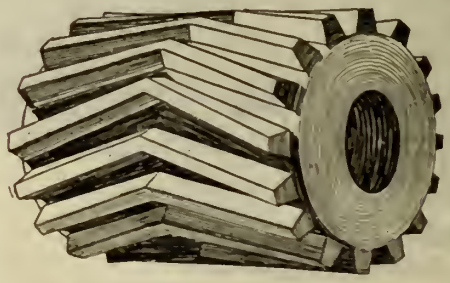
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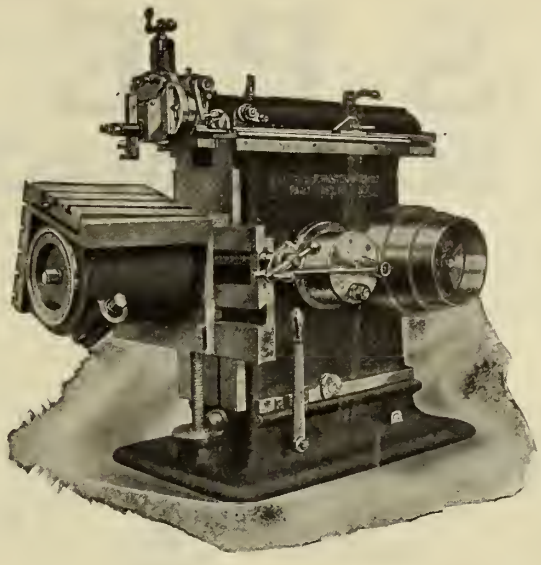
The Tube Company of Canada LIMITED

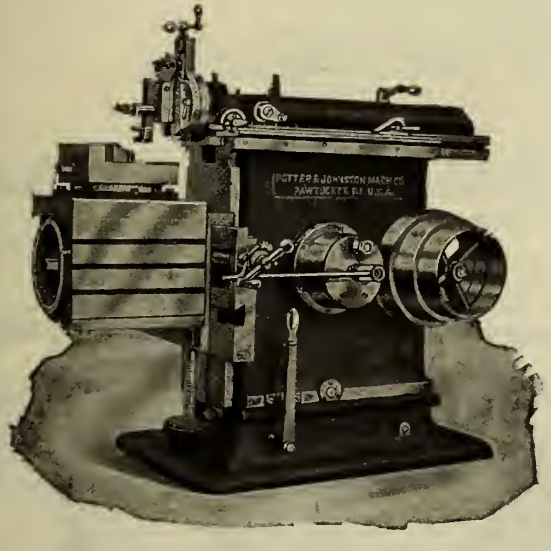
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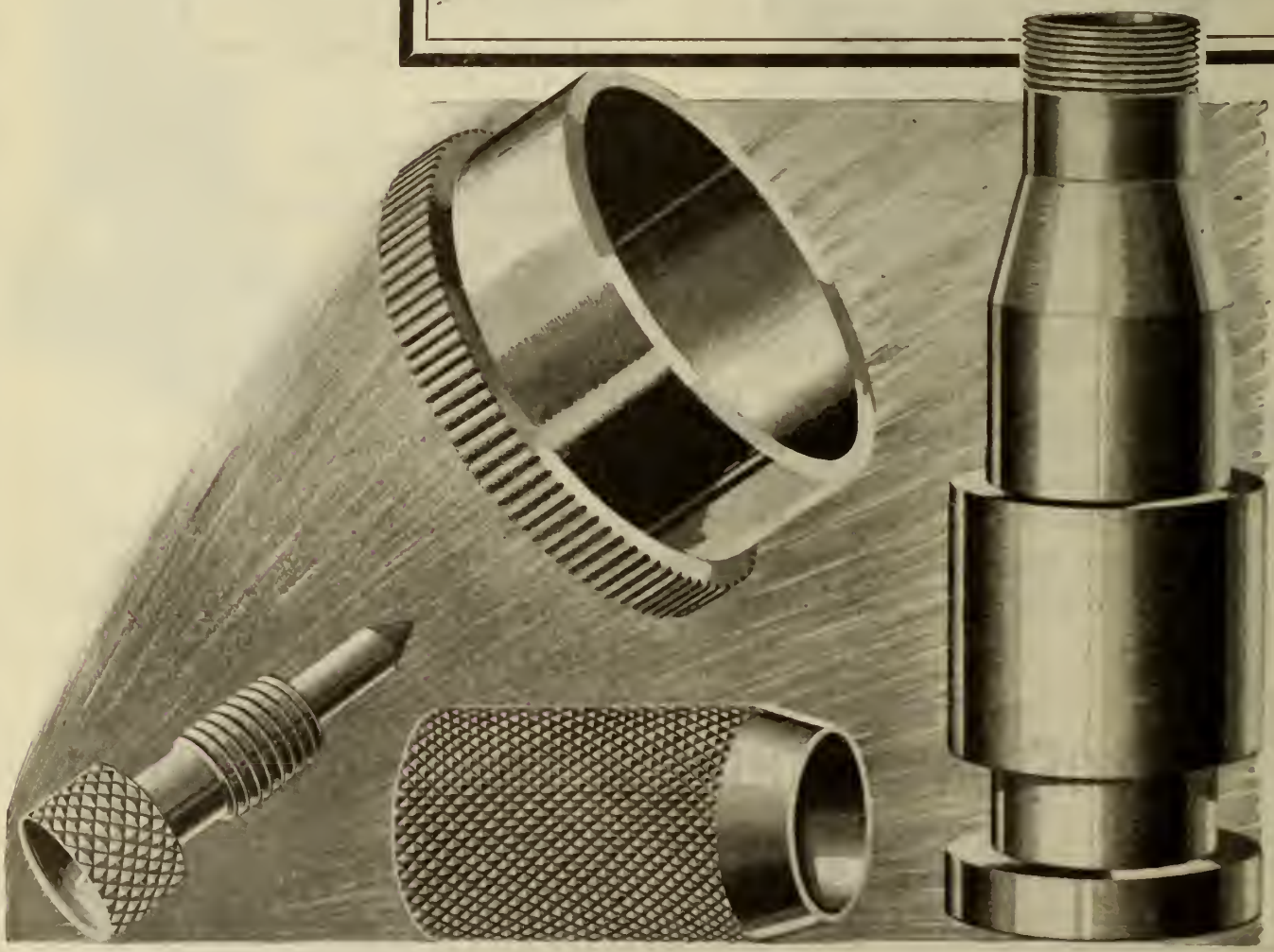
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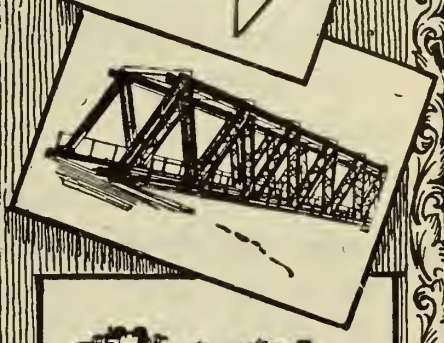
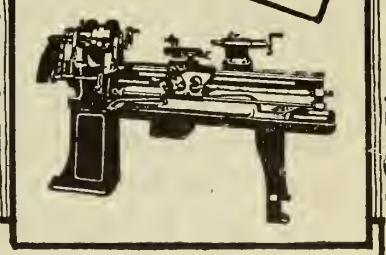
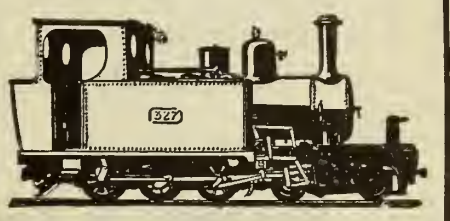
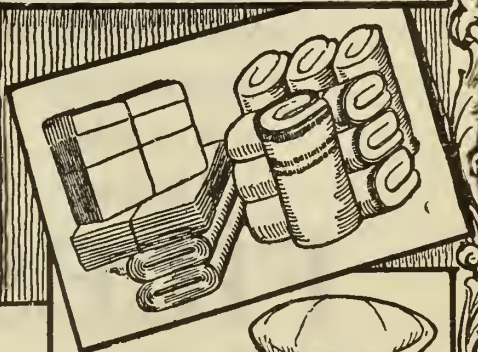
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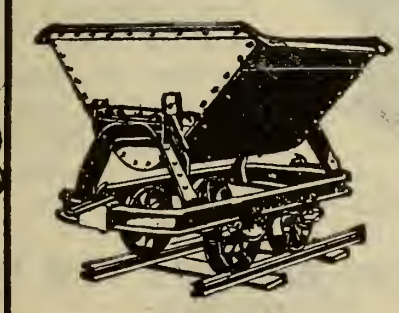
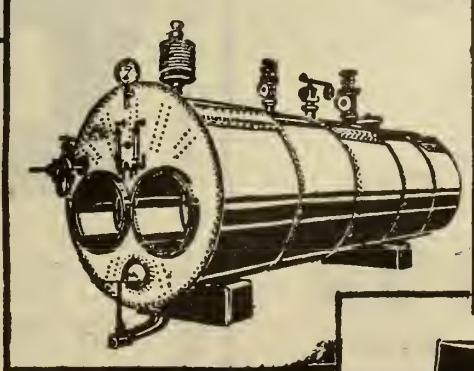
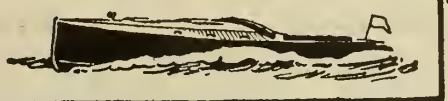
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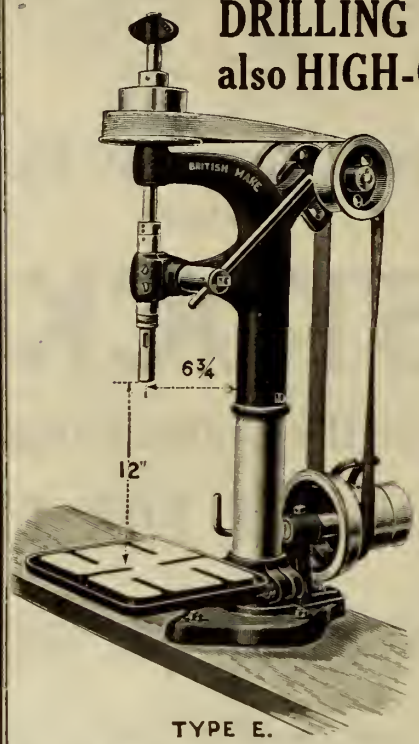
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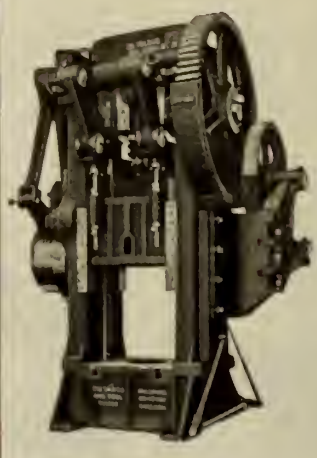
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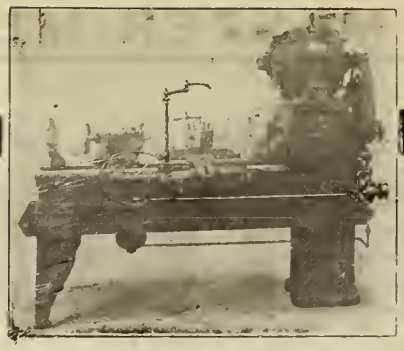
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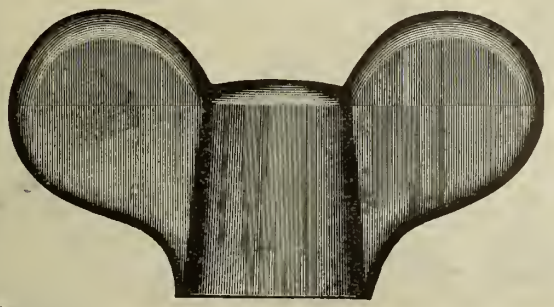
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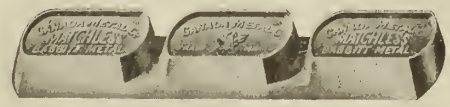
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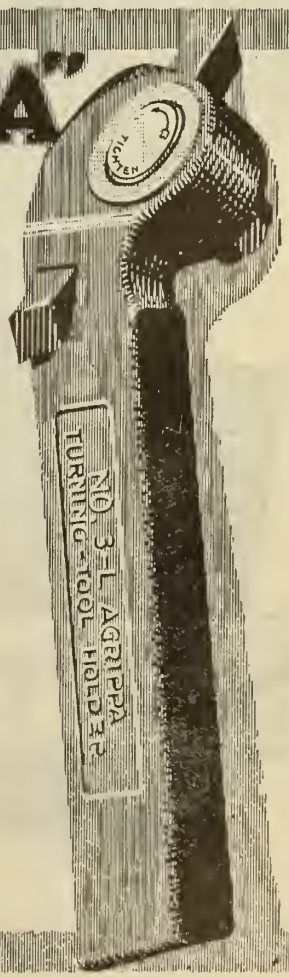


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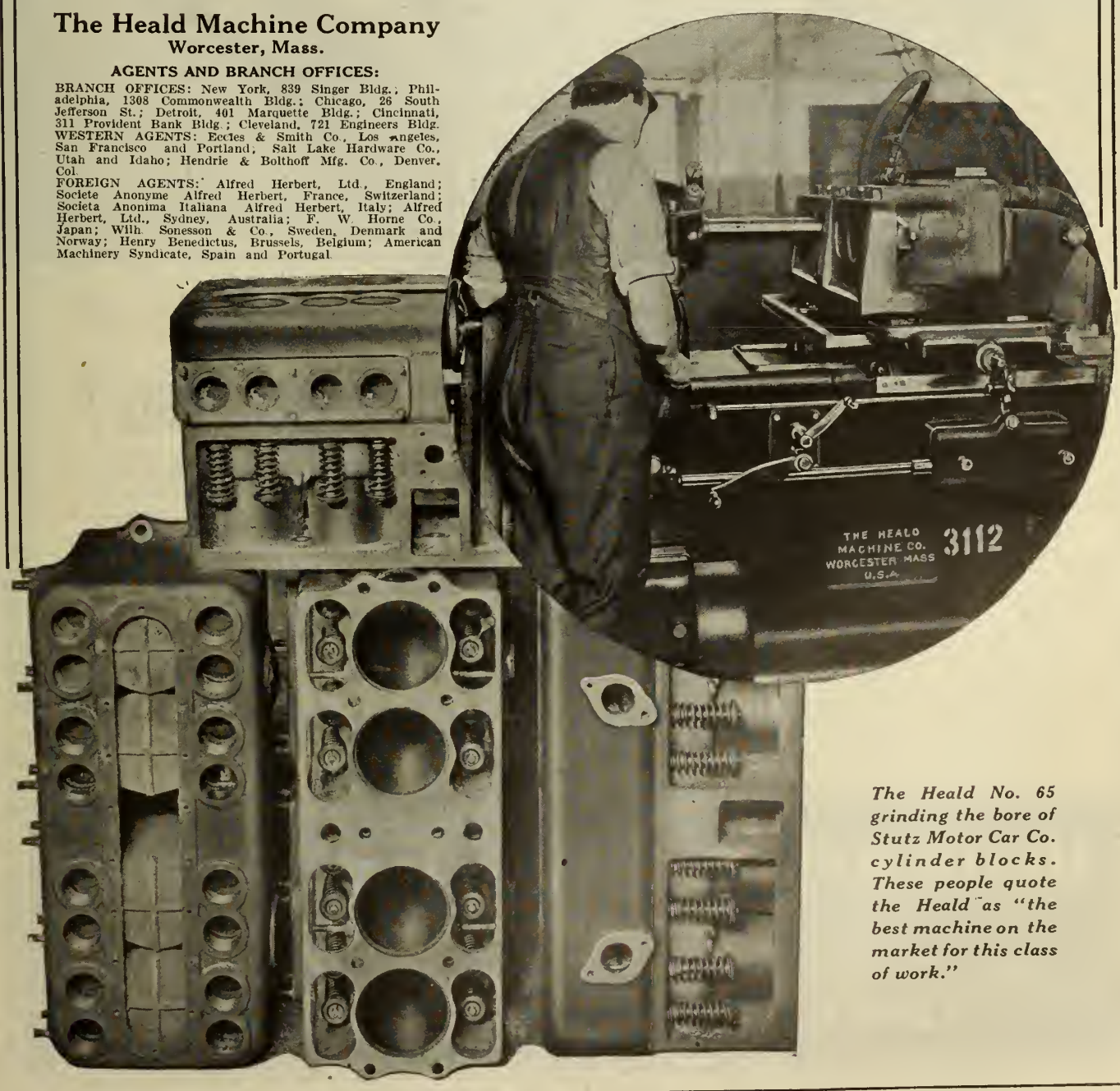
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The Heald Machine Company
Worcester, Mass.

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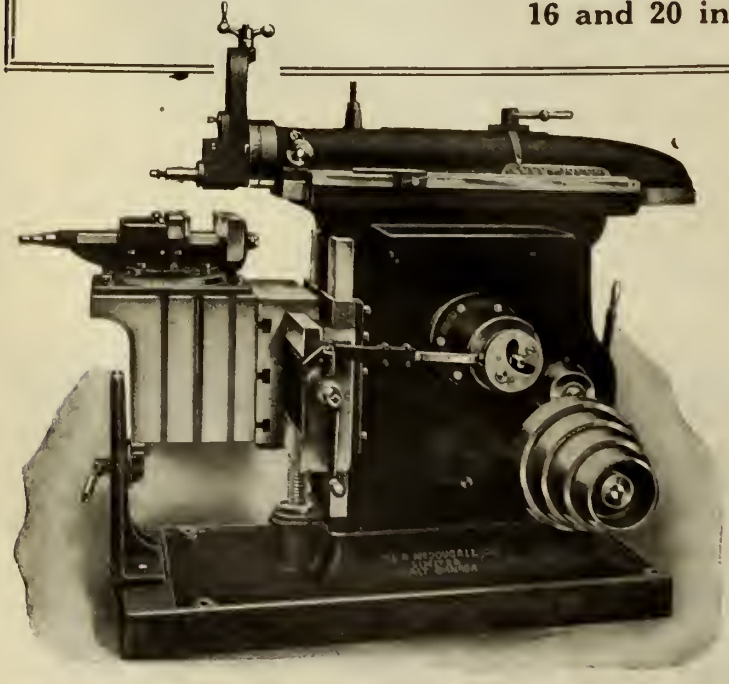
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How HOEFER Factory tests protect HOEFER Driller Users

INSPECTION CARD

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No. 6973 Lot 170 Size 28
All oil holes in proper place Yes Take oil freely Yes Loose pulley turns freely Yes Core pulley shows balanced Yes Runs true on face Yes Runs true on O. D. Yes Drive pullies run true Yes Crown gear and Pinion runs true Yes Are gears noisy No Run smooth Yes Were gears filed No. All back gears run true Yes Noisy No Back gear lever shifts gear O. K Yes Does B. G. box run hot No Feed worm wheel and worm on top shaft mesh O. K Yes Feed works with lever in each position Yes Power feed lever throws feed in and out O. K Yes Automatic stop O.K Yes Hand wheel feed throws in and out O.K Yes Crank handle fits elevating screw gear stud Yes Elevating screw works O.K. Yes Two handle screws in table arm Yes Spindle nut runs true Yes Ball bearing, yes yes no .... Drift hole O. K yes Variation top test bar .0006 ... Variation bottom test bar .0021 ... Plain lever —. W. and L. —. W. L. B. G. —. W. L. P. F. —. Complete ✓
Motor drive —. Belt ✓. Gear —. Motor at factory and fitted to machine —. Kind of Motor ..... No. —
H.P. —. Starting box with motor ....
Geared Tapper—Are gears noisy ..... Run smoothly .....
Were any gears filed —. If filed, state which gears ..... Any bearing run hot ..... Friction works O. K ..... Gang driller .....
No. of spindles ... oil pump .... Tank and Piping ...
Sliding Head — Crank handle fits stud Yes. Two handle gib screws Yes One set gib screws Yes Head will go to top and bottom Yes Ways Yes Finish on all polished and ground parts ... Yes ...
General appearance of machine ... OK .....

Inspected by ... No. 2 .....

Table Test Variation face with stud .00 OK ... Table test with spindle at back .00 0 .. R. side .00 0 high. L. side .00 2 high .... Front .00 5 high Table stud fit OK .....

Tested by ... No. 2 .....
Condition, painting and finish OK ..... General appearance of machine ..... OK ..... Inspected by A. K. .....
Machine properly slushed ✓ ..... Machine properly packed ✓ .....
Sales order No. 25697 ..... If motor drive, was motor —
Was starting box —. packed and shipped with machine —.
Date 6-9-18 ..... By W. E. .....

Here is a typical Hoefer Driller factory inspection card. As a thorough investigation of every item that could affect the satisfactory operation of a driller, it's as searching as a Government Census chart. We fill out and keep on record a similar card for every Hoefer Driller that leaves the factory—and no Hoefer Driller can be shipped before all these questions are satisfactorily answered.

Read the card. We think it answers every question you'd like to make sure about before buying a driller. But if there are any other points you want checked on **your** Hoefer Driller, we're prepared to investigate them as well—for there isn't a single detail of Hoefer Driller design and construction that can't stand up under the most severe inspection or operation. Hoefer Driller service records have been proving that for 25 years.

Let your next driller be a Hoefer—you'll find it a worthy addition to your equipment and a decidedly worth-while investment.

21

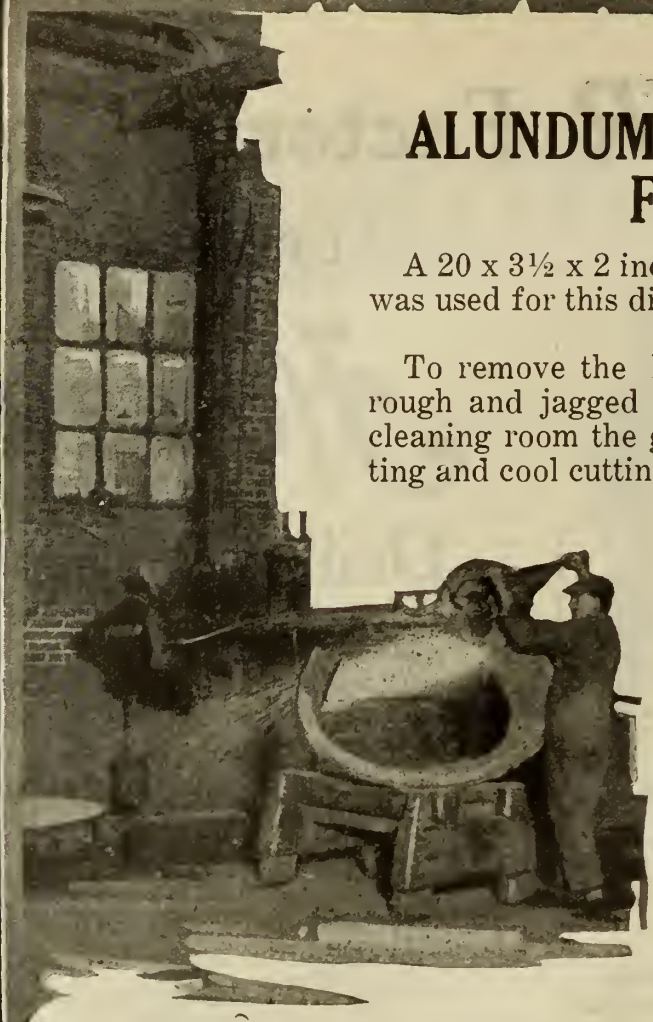
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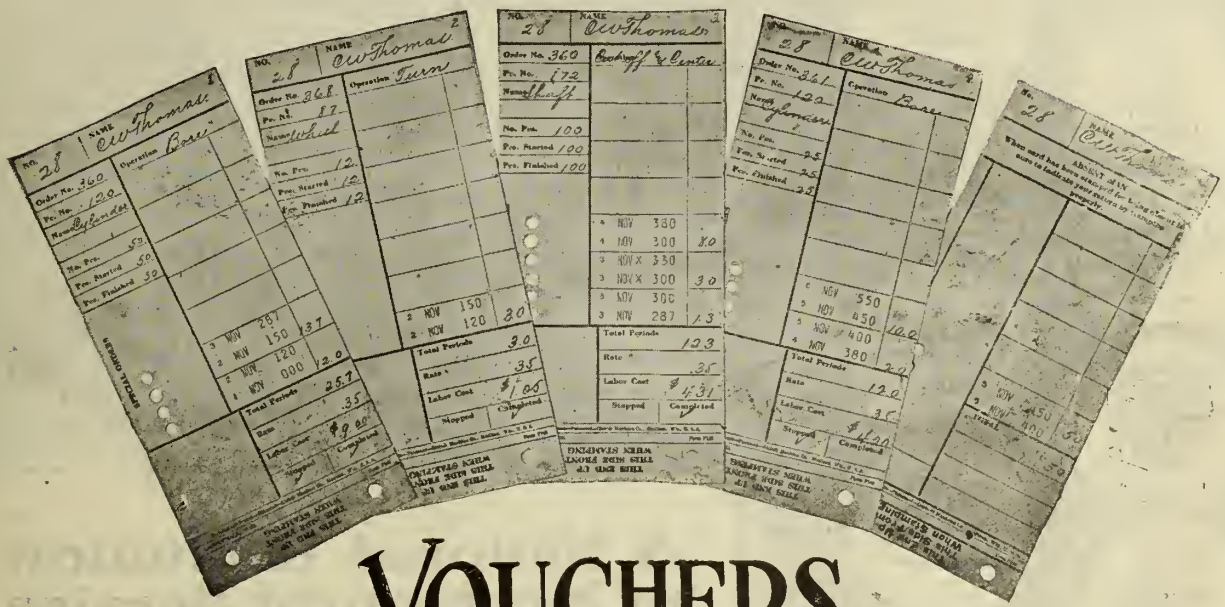
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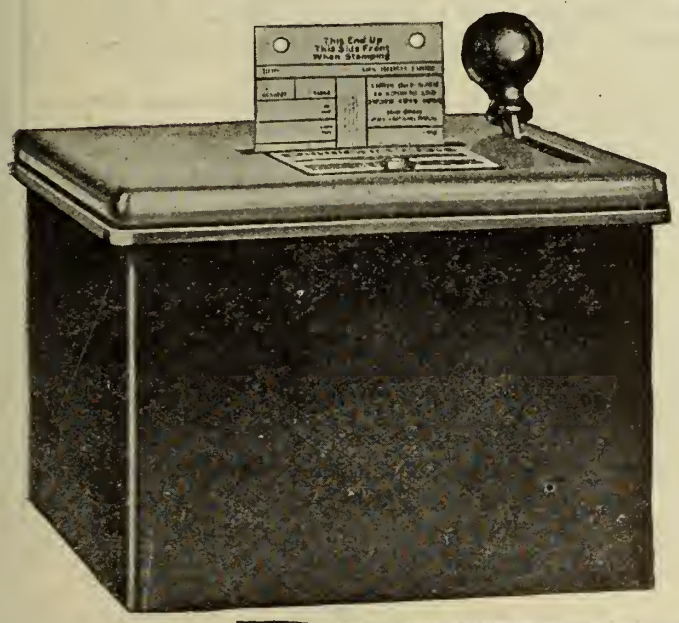


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CANADIAN MACHINERY
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VOL. XXIV. No. 25 December 16, 1920

Six Examples of Simple Chucking Devices

Chucks for Machining Small Washers, Facing Rough Nuts, Machining the Ends of Short Threaded Parts, Drilling Small Holes at Right Angles to Main Axis, and Other Parts

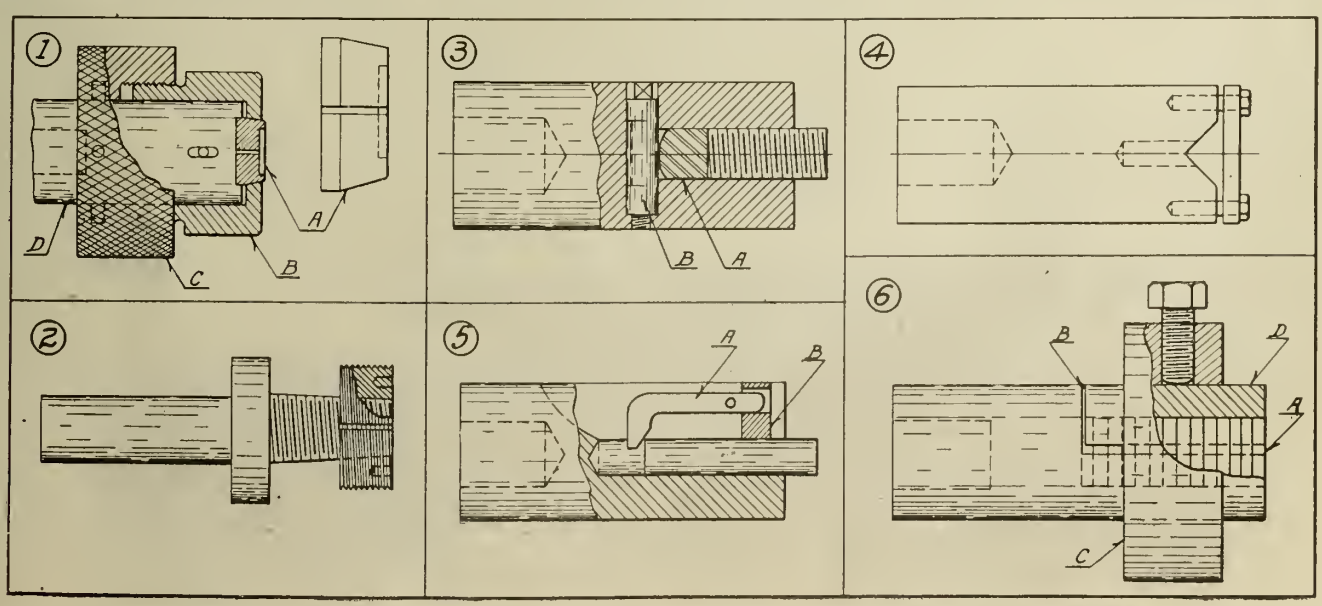
By F. SCRIBER

DRAWINGS of a number of chucking devices are here shown. These were originally designed for lathe use, but slight modifications would make the same adaptable for turret or screw machine service. The chuck shown in Fig. 1 is used for machining small washers on the face. It consists of a spring holder A, bored to take the washer and split in one place only. The piece B is a sliding fit on the body D, and is threaded to engage with the knurled tightening nut C. This nut is grooved in the shoulder at the rear. A hole is drilled in line with this groove, so that when the nut is in position on the arbor, the locating pins may be driven into the arbor, thus allowing the nut to turn freely without any lateral movement. Work of any desired diameter, within the range of the chuck, may be done by making suitable spring holders. This particular type of chuck has a comparatively long life as it does not rely on screw threads for maintaining its concentricity.

The piece shown in Fig. 2 is more in the nature of an arbor than a chuck. It was designed to be used in facing a large number of black or rough nuts square with the thread. In order to do this it was essential that the nuts should tighten up on the thread and not against the opposite shoulder. It will be noted that the arbor proper has a slightly tapering thread on which the split collar is located. The nuts are threaded on the collar by hand and the collar is turned by means of a pin wrench, until the nut is firmly held. When machining the end of short threaded pieces, threaded studs, etc., it is often difficult to get them off after the machining operation. The chuck shown in Fig. 3 was designed to overcome this trouble.

The work when screwed into the chuck, bears against the piece A (which is a sliding fit in the hole) and in turn, this piece presses against the pin B, which is inserted at right angles and with a nice turning fit, threaded on end and provided with a square on the other end for using a box wrench. The pin B has a portion in the centre filed in the form of an eccentric so that the work can be easily released by simply turning the pin after the machining has been performed. The small thread on the end of the pin B is simply to retain it in position. In Fig. 4 is shown a simple but serviceable chuck for use when drilling or boring small holes in round stock at right angles to the main axis. A chuck of this kind will take care of a great variety of work, such as the enlarging of holes or the turning of odd shapes in previously drilled holes.

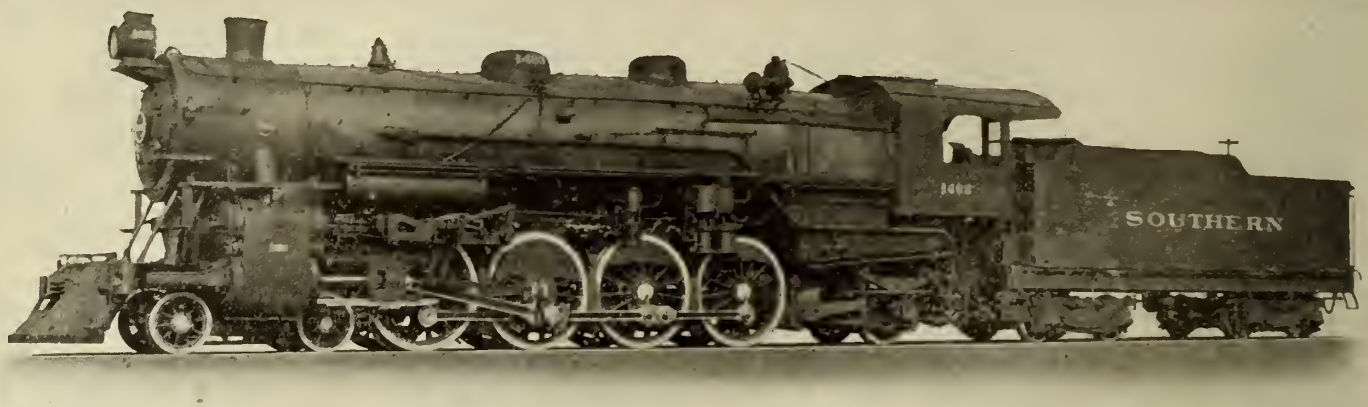
When a large number of short round pieces require to be centred the chuck shown in Fig. 5 will be found to be very handy. The chuck is bored to take the desired diameter of stock and is slotted on one side to enclose the lever A. Before slotting, a hole is drilled at the forward end to take the small brass pin B. This pin is provided with a slot in which the short end of the lever operates; this slot must not be cut too wide as there is a possibility of the pin falling out when work is removed, or interfere with the



THIS GROUP SHOWS THE SIX IDEAS; EACH OF WHICH THOUGH SIMPLE IS VALUABLE.

work when placing in the chuck. When pressure is applied to the outer end the inner end presses against the tail of the lever, thus forcing the pin B down upon the work. The advantage of this chuck is that the machine need not be stopped to change the pieces of work, as the work can readily be removed when pressure is released.

The chuck shown in Fig. 6 is used when drilling or reaming a large number of washers, several of these being placed in the chuck at the one time. When making the chuck the centre hole is first drilled and bored to the desired size and afterwards split as shown, so that the top half may be removed to facilitate loading and unloading. The ring C was bored to fit closely and drilled and tapped for the tightening screw. When loading the clamping ring is released and slipped back out of the way. In a chuck of this description the operator has a clear view of the work as the pieces are placed in the holder. All of these chucks can be made from discarded material about the shop and frequently eliminates the necessity of securing castings for the making of impromptu equipment.



Development of 8 Driving Wheel Locomotive

By J. SNOWDEN BELL

IN the December 2nd issue we touched upon certain phases in the development of the eight driving wheel locomotive. This article is the conclusion of the story. Readers have no doubt followed this development with interest, and it might be well to add that we secured the data from record No. 89 of the Baldwin Locomotive Works. Let Mr. Bell continue with his story.

A comparatively recent locomotive of the type, engine No. 19 of the Lake Superior & Ishpeming Ry. (Fig. 12) indicates the great increase in size and power which has been made in this type since its origin in 1864, and development in the "Consolidation" of 1866. This engine was built in April, 1916, and its dimensions are as follows: Weight, 268,000 pounds; on driving wheels, 238,000 pounds; cylinders, 26 x 30 inches; driving wheels, 57 inches diameter; boiler, 88 inches diameter; heating surface, 3643 square feet; (superheater, 844 square feet); grate area, 58.7 square feet; boiler pressure, 185 pounds; factor of adhesion, 5.25; maximum tractive power, 56,000 pounds.

"Mikado," 2-8-2 Type, 1897

The next succeeding step in the development of the eight driving wheel locomotive was the addition of a two-wheeled trailing truck, this wheel arrangement characterizing what is known as the "Mikado" or 2-8-2 type, which was first applied by The Baldwin Locomotive Works in 40 engines built by them for the Nippon Railway of Japan, in March, 1897. The advantage of this type, in affording a substantial increase in boiler capacity, was immediately and generally recognized, and it has practically superseded the 2-8-0 type in heavy freight service. Many 2-8-0 engines have been rebuilt in conformity with the 2-8-2 type.

Fig. 13 represents a high power 2-8-2 type locomotive which is one of a lot built by the Baldwin Locomotive Works for the Chicago, Burlington and Quincy R.R., in June, 1917. This locomotive weighs 314,700 pounds; weight on driving wheels, 239,200 pounds; cylinders, 28 x 32 inches; driving wheels, 64 inches diameter; boiler, 88½ inches diameter; heating surface 4,465 square feet; (superheater, 1031 square feet); grate area, 78 square feet; boiler pressure, 180 pounds; factor of adhesion, 3.98; maximum tractive power, 60,000 pounds.

"Mountain," 4-8-2 Type, 1911

The latest design and probable limit of capacity of the eight driving wheel locomotive appears in the "Mountain" or

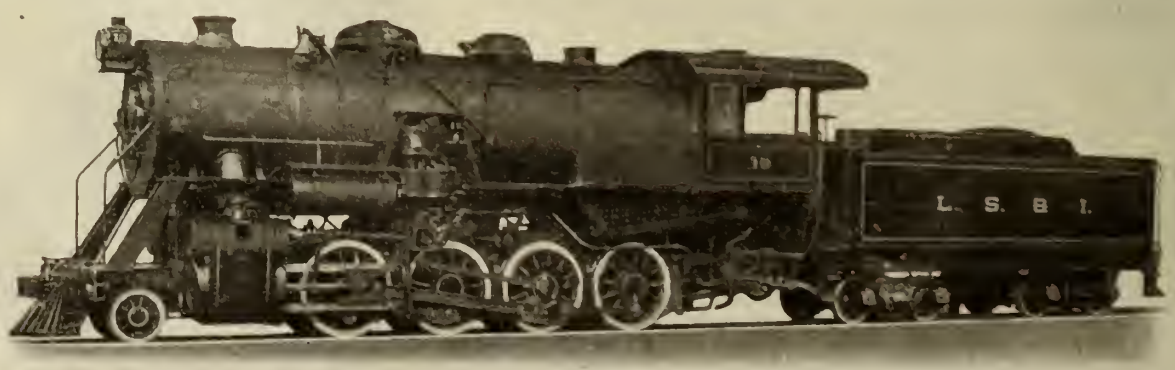


FIG. 12.—THIS ENGINE WAS BUILT IN 1916, AND IS USED ON LAKE SUPERIOR AND ISHPEMING RAILROAD.

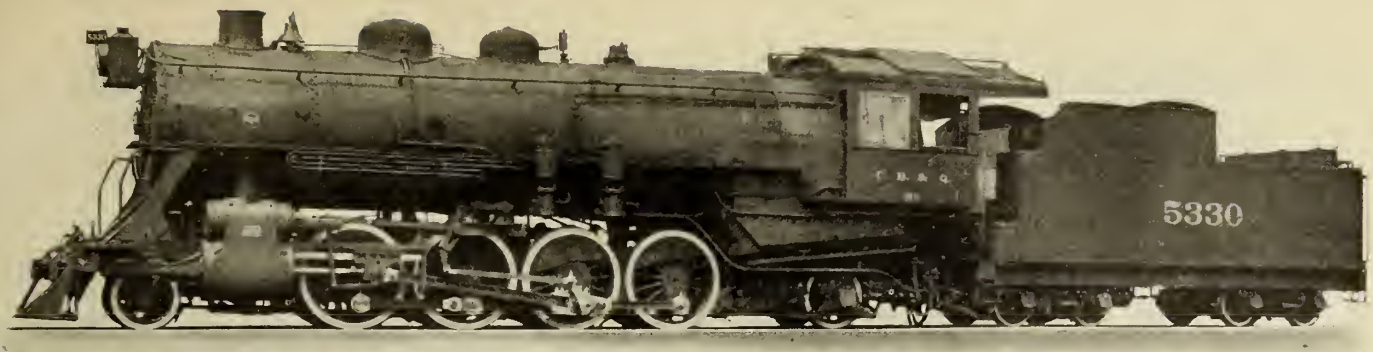


FIG. 13—A HIGH-POWER 2-8-2 TYPE LOCOMOTIVE BUILT FO R THE CHICAGO, BURLINGTON AND QUINCY RAILROAD.

4-8-2 type, in which a four-wheeled leading truck is substituted for the two-wheeled truck of the 2-8-0 and 2-8-2 types and which was originated by the American Locomotive Co., in locomotives built by them for the Chesapeake & Ohio Ry., in 1911, for passenger service, in which they have hauled trains of 645 tons over grades of 1.82 per cent. at a speed of 26 miles per hour.

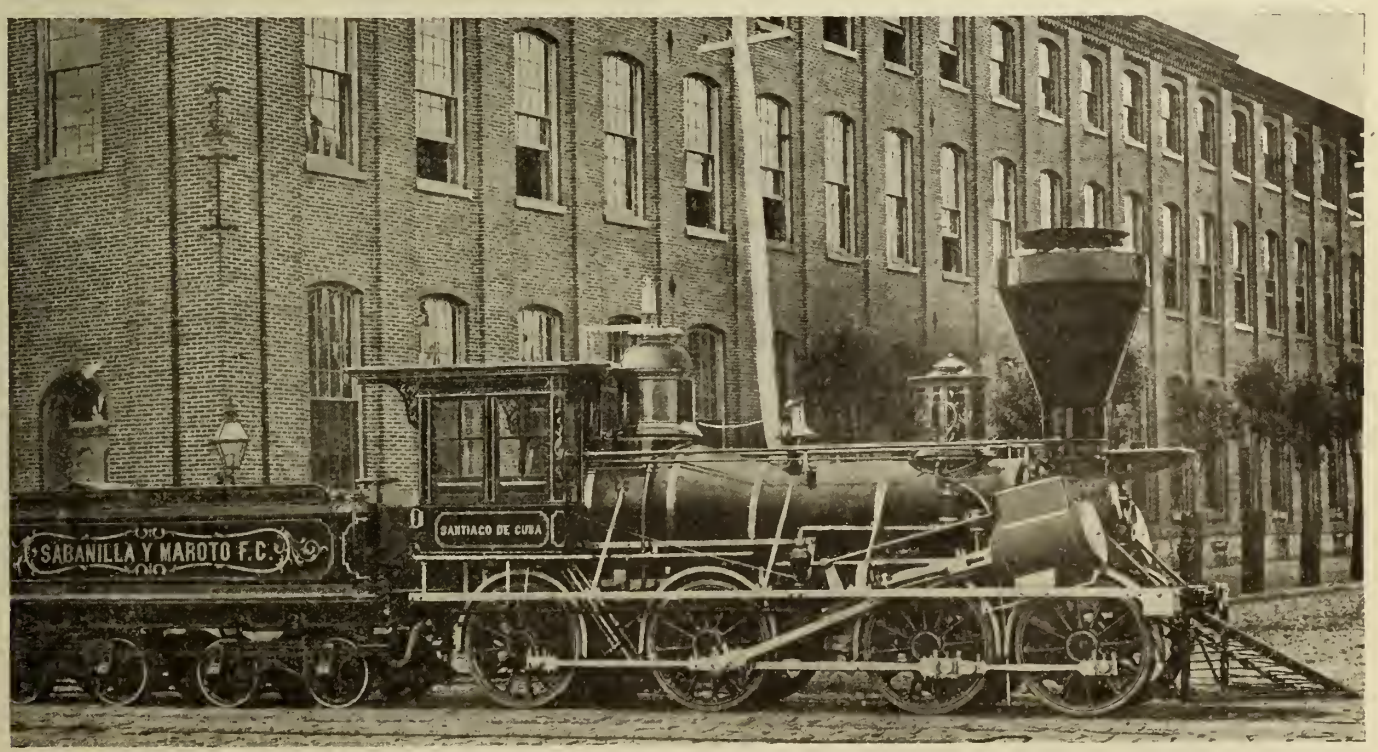
The heading of this article illustrates one of a lot of locomotives of the type, built for the Southern Ry. by the Baldwin Locomotive Works in 1917. The principal dimensions are as follows: weight, total, 314,-800 pounds; weight on leading truck, 53,800 pounds; weight on driving wheels, 209,800 pounds; weight on trailing truck, 51,200 pounds; cylinders 27 x 28 inches; driving wheels, 69 inches in diameter; boiler, 76½ inches diameter; heating surface, 3,668 square feet; (superheater, 942 square feet); grate area, 66.7 square fet; boiler pressure 190 pounds; factor of adhesion, 4.38; maximum tractive power, 47,800 pounds.

Except as to the greater safety of a four-wheeled leading truck at comparatively high speeds, and the capacity of a slightly longer boiler, the 4-8-2 type presents no substantial advantage over the 2-8-2, while on the other hand, it is subject to the objection of reducing the proportion of weight available for adhesion. Thus, the 4-8-2 type for the Southern Ry. carries 66½ per cent. of its total weight on driving wheels, while in the 2-8-2 type for the Burlington, illustrated in Fig. 13, the proportion is 76.0 per cent. The speed of passenger trains on mountain grades is not so high as to render a two-wheeled leading truck unsafe, and the possible increase of boiler capacity in the 4-8-2 type is not great.

The exceedingly great increase, shown by the foregoing review, in the size and power of the eight driving wheel locomotive over the Baldwin direct coupled engines of 1846, which may properly be considered as the earliest instances of the designs that were adapted to continued practical railroad service, has, of course, been accompanied, and rendered economically available by the numerous improvements in structural features and accessories which have been embodied in locomotives of the various other designs that have from time to time been introduced. The advantage of the design, as practically perfected in the improved types in which it has been applied, is unquestionable, and other than for exceptional conditions of service it will doubtless continue to be the preferred one for freight train work.

AN EXPLANATION

Through a regrettable error in our Advertising Copy Department engravings were taken from an article on Die-Castings, which showed examples of work done by the Franklin Die-Casting Corp., and the cuts were used in the advertisements for the Fisher Motor Co. The Franklin Die-Casting Corp. have written us stating that they are the originators of the process described in the article, and that the Fisher Motor Co. are in no way connected with the Franklin Die-Casting Corp. either by license or otherwise. We have pleasure in making this explanation and correction.



AN 8 COUPLED, FLEXIBLE BEAM TRUCK LOCOMOTIVE BUILT FOR SABANILLA AND MAROTO RAILWAY, CUBA, IN 1866. THE WEIGHT IS ABOUT 65,000 POUNDS.

Canadian Firms Discuss Their Production

Some Firms Find That the War Shop Still Exerts an Influence—Many Forces Have Been at Work in Recent Years to Break Up the Organizations in This Country

TO what extent has production fallen off in Canadian factories during the past three or four years? This paper put the question to a number of manufacturers, holding that if such were the case a remedy should be found, and if, on the other hand, production had not dropped off, it was not right that the Canadian workmen should be credited with having anything to do with such a condition. Some of the information was secured a few weeks ago and conditions may have changed somewhat since, but there is, in the main, a very fair analysis of the whole situation.

One Kitchener shop says: "Unfortunately we are not in a position to give you much information regarding this point, as our line of manufacture is such that we have no accurate means of determining just what the production per man is, as compared with years past, and are not able to give you particulars regarding this point.

"The situation with us, however, has been such that the housing accommodations in our city were totally inadequate and we have been obliged to employ a great many young unmarried men. These we have found would not work steady, owing apparently to the high wages which they were receiving. This has caused us a great deal of trouble and has reduced our production very materially.

"With the change, however, in labor conditions we find a better class of help available and are gradually replacing men of this type. We regret that we cannot give you any more information, but shall be interested in the results which you obtain from various firms from whom you are asking for information along this line."

Goes Over the Whole Situation

One Canadian manufacturer discussed the matter at considerable length. He has been a careful observer of passing events, and looking back over a period of several years, says:

"You have raised a large question. Almost any manufacturer will tell you offhand that production per man has fallen off sadly in the last year or so, but it is hard to lay one's finger on the exact reason for this. General Booth, on his return to England after a world tour, recently stated that what the worker wanted, in his opinion, was not a bigger wage, but the opportunity at all times to do less work. From my own observation, I am in agreement with the General.

"Plants have changed so in the past six years that we have literally no standards to guide us in an impartial judgment of what constitutes a real day's work. Before the war there was always some record which had been set up at one time or another by a highly skilled operative; this passed into shop history, but became a standard by which performance and pay were unconsciously regulated.

"Then came the shell business, with the consequent breaking up of organizations by enlistment and the bigger pay offered in the new shell shops. We have all been obliged therefore, to enlist any help we could get hold of to keep the plants running at all. The men who were known as steady workers before the war were absorbed immediately and gladly, but the waverers before became the shirkers after. This, mark you, was not entirely their own fault. They had lived for five years under abnormal conditions, having no responsibility, just doing what they were told to do, and living from day to day. They had no fear of not being clothed or of having their meals at some time or other.

"When the trade boom of June, 1919, came along, factories were just beginning to settle down with a fairly complete organization. The motor trade in particular, and allied industries also, were in dire need of all sorts of help and commenced to offer inducements to get men into their shops. This again broke up the working forces of all factories. Here in Western Ontario we felt that we were merely feeding the factories of Detroit. The labor turnover was out of all proportion to the force employed, and most factories were left with the mass of their workers half trained, and consequently, production per worker was again cut. Here again the question of standards enters. With an almost new force, there can be of necessity no actual standards. It is a matter of laborious training to secure any.

"It is unfair to compare the production of semi-skilled men with that of old workers in any given industry. However automatic machinery may be, there still enters the personal element and aptitude to any particular job. But in our own particular industry, we are only getting a little more than half the production we were before the war on the skilled and semi-skilled jobs. We introduced a bonus scheme, but the necessary proportion of labor to output was never attained.

"Perhaps the experience of this factory has been unusual, as all our help has had to be trained from the raw, so to speak, but the results have been as noted above and production has been far below that of pre-war days. I believe the men and women we employ are doing their best, as far as they know, but for the reasons briefly outlined above it is not a very good best. I do not believe that the majority of our helpers are wilfully trying to hold up production, but the era of higher wages has unsettled them to the extent that they are not anxious to learn thoroughly any particular job.

"With regard to coming into close contact with men, in normal times this is not difficult in small towns, as the outside interests of both employers and employees move along the same lines. In lodges and churches, sports and clubs, they meet on the same ground and have very often been brought up in the same school. But latterly we have had a large percentage of "floaters" with whom we have nothing in common. These men do not enter into the social activities of a town at all. An employer has therefore no means of judging these men except by their performance in the shop, and for some months can get no 'line' on them."

Labor Is Inefficient

A manufacturer in the steel trade in one of the industrial centres of Quebec tells his experience as follows:

"Our experience is and has been for some time that labor is very inefficient; production per man has fallen off from 30% to 40%, and is about on that basis now as compared with pre-war conditions. We have seen it stated that in some plants production per man was increasing, but this has not been our experience. We can see no improvement, but possibly it may reach us later. Conditions with us are probably about the same as they are with other manufacturers. Labor is inefficient, careless and independent. Spoilage is much greater than normal because of carelessness of labor.

"We have made use of no particular method except to at all times talk with our men on the desirability of increasing output and becoming more efficient. We do not pay bonuses, but advance our men regularly as they improve. There is no reason that we know of why production should be more difficult, in fact everything tends to the contrary, as we are always on the lookout for new machinery and new tools, and our plant is probably the best equipped plant in Canada for the manufacture of the line of goods that we market. Shop conditions could not be improved; living conditions are above the average. We

are inclined to think that with the gradual decline in the cost of living, and the fact that a great many plants are reducing their forces, in a short time there will be a surplus of help and that they will be more efficient."

Piece-Workers the Same

A St. John, N.B., firm, discussing the matter, has had the following experience: "In our finishing shops we could not say that we have had occasion to find any decrease in production per man, as all our work of this nature, to a large extent, is handled on piece work; the same also applies to our moulding shop. However, with our laborers we have noted a remarkable decrease, but at the present time, indications seem to point for an improvement in this class of work."

Supply and Demand

This firm is in a good industrial district in Ontario and the experience would no doubt be that of many others: "In a plant the size of ours we have not the figures to prove the actual falling off in production that may have taken place in the last number of years. In parts of our plant where a premium is paid for increased production the falling off is not so noticeable, but in the parts of our plant where we have not been able to do this we get considerably less production per man than we did before the war.

"The situation arose, of course, out of the very great need for men during the war and the lack of a sufficient supply. We think that the condition in our plant is a little better now than it was a few years ago, owing possibly to the fact that business is not so brisk and we may need to lay off help before many months have passed. They seem to sense things such as this and naturally we get a little better effort on their part.

"The whole question, to our minds, simmers down to a question of supply and demand and we think chances are that within the next six months all concerns in the country can expect much more efficiency than they have been favored with before."

Piece-Work the Best

A Nova Scotia firm believes that piece-work is the best plan to keep production up, and gives its experience as follows, this being an engine and boiler industry: "We would advise that in our opinion there has been a decided slowing down of the production per man as compared with pre-war conditions. We have found that this can be remedied and almost completely overcome by introducing piece-work and offering the men an inducement for speeding up. We are introducing piece-work now in almost every department, and the result has been most surprising. In some cases we have actually reduced our costs to one-third of that previously prevailing by this means."

Compares 1918 and 1920

This firm is in the foundry business in a Quebec centre and apparently has taken some trouble to keep in touch with past performance on the part of its force. Its experience is as follows:

"In reply to your letter we wish to say that a few days ago we took up the question of production of our plant for the month of August in the years of 1918 and 1920. This showed a falling off of nearly 20% and this indicates that there is considerable truth in the statement which seems to be general that labor is not producing to the same extent as prior to the war. The production in a foundry producing miscellaneous castings is naturally affected by the class of work handled in the periods under observation, and as we are now making more miscellaneous castings than in 1918, we think that this is one reason for the falling off in production. We have no special methods to secure better effort on the part of the workmen, but we arrange as far as possible to pay them on a piece-work basis, and find that production on a piece-work basis will vary from 10% to 50% over day work. Generally speaking, we are free from labor troubles. Ours is an open shop and whilst we pay union wages and better in some cases, we do not deal with the men collectively.

"International organizers or agitators have endeavored at different times to stir up trouble, but the majority of our men are satisfied with the working conditions and will not listen to them. We cannot truthfully say that there is any tendency on the part of our workmen to hinder production. We may have some employees who hinder production by laziness, but not by intent."

Still Feels War Influence

The war shop is still felt in many places, and it has not been eliminated as a disturbing element where fine work is necessary. This firm operates its Canadian plant in Quebec. The general superintendent discussed the matter of production at some length:

"It is pretty hard for me to give you any figures regarding this subject. I do know that the production was increased in all departments of this plant, but whether it has also been successful from a monetary standpoint is a question that I am not in a position to answer. We feel that the production in any plant can fall off just the same as the quality of supervision will fall off, and not come up to standard, and when this latter condition exists, the plant will fall into a listless condition and if not wakened up by those in direct touch with the figures, will gradually fall into a state where it is almost impossible to again reach the old standing.

"My reason for the loss in production, in a great many plants is that the plants are now full of war-time mechanics and other workmen who served their apprenticeship and became master workmen in one operation. The regular men of a great many plants were influenced to change from one plant to another, to sell their labor to the highest bidder so that the old-time mechanics were scattered to the four winds, some of them never returning to the plant in which they worked before the war. When the different plants returned to their standard productions, it was a case of a few men who were left out of the original organization, having to break in a great many, who I think are only apprentices. We are not entirely free from this condition and it requires that we keep an active watch on all operations, feeds, speeds and other methods pertaining to rapid production, or we would have to agree that we are losing ground. On the contrary, however, there are three conditions: first, standing still; second, going back to failure, and the third, going on to success. And I for one am unwilling to admit anything in connection with our plant excepting the last condition, because I believe if I had to I would be admitting that this company was working on the down and out course."

A Good Word for the Men

An Ontario firm, making several lines in the iron, steel and metal industries, believes that some care should be taken about statements made regarding the way in which men abuse shop privileges. This firm holds that in 85 per cent. of cases the men are trying to be square.

"It is a most difficult matter for us to answer with any degree of accuracy. We have made very considerable changes during the past five or six months which makes it a very difficult matter to make positive statements along the lines your letter asks information upon. My own judgment is that in any factory there are a certain number of men, say 15%, who are out to get as high a wage as possible, for as small amount of work as they can get along with, giving in return, but the other 85% are good, decent chaps who want to do the fair thing and give a return for the money paid them.

"We believe this applies to our own staff here and we naturally do not want to be advertised as giving out the information that production per man has been universally less during the past years. Hours of labor have been considerably shortened, while wages have been increased, and the cost of production to manufacturers has, without doubt, risen on a given amount of the company's product. We have consequently been compelled to assess our customers a higher price for this reason, and also for the reason that the same principle has made the cost of our materials higher or at least has been one factor in doing so."

Rope as a Means of Power Transmission

English Practice Regarding Rope Drives—The Three Versus Four, or More, Strand Ropes—Spiral Elongation, the Life of Rope, Rope Guards, and Effect of Moisture.

By J. MELVILLE ALISON

THE subject of ropes for power transmission is one that has received close attention in England. In fact engineers in that country have given closer technical and practical consideration to the subject than we have perhaps on this side of the water. For this reason we append the following article which was presented before the Engineering Institute of Canada with an object in view, viz., to create interest.

Features of English Practice

The outstanding features of English practice may be briefly stated as follows:

(1) Cotton has entirely supplanted any other material for transmission work in England—manila is of the dim and distant past.

(2) The ropemaker is consulted as to plant lay-outs speeds, sheave diameters, centres, grooving, etc., and his opinion is deferred to.

(3) Guarantees of maintenance are required and given in almost all installations.

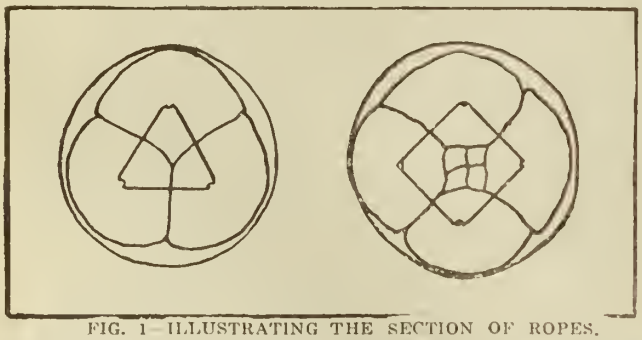


FIG. 1—ILLUSTRATING THE SECTION OF ROPES.

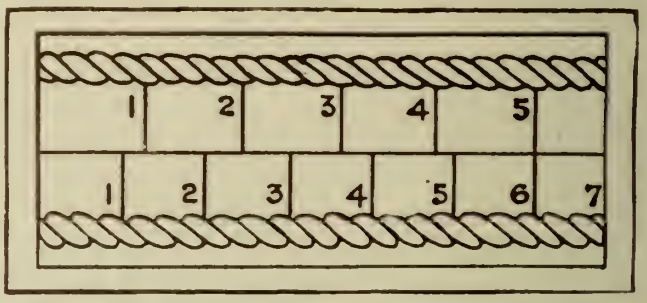


FIG. 2—SHOWING SECTIONS OF SPIRAL ELONGATION.

(4) The manila and steel rope manufacturers employ cotton ropes for transmitting their power.

(5) The efficiency and longevity of cotton ropes have commanded the employment of this material in the manufacture of transmission ropes.

In discussing the question of cotton or manila for transmission ropes, one must not lay too much stress upon initial cost, for although cotton is dearer than manila, its superior resilience, grip and groove impact add so greatly to driving force that up to one-third more horsepower may be transmitted. Further, its prolonged life being reckoned at approximately five to one will reduce apparently excessive first charges to an insignificant item.

Three versus Four (or More) Strand Ropes

Rope of three, four, or even seven strands is sometimes employed, but since the contest lies mainly between the three and four strand, it will suffice to demonstrate the advantage held by the three-strand over the four or any other construction.

Examining the section of a three-strand rope, Fig. 1, we obtain an equilateral triangle by connecting the centres of each strand, demonstrating the triangulation of the strains, a principle adopted by all engineers in erecting angular constructions, such as bridges, etc. In a rope of this construction we have a trinity of elastic spirals, so supple that they will bend to and fro without disturbing their formation. With the four-strand rope, adopting the same method of connecting the strand centres, we obtain a square and an illustration of the parallelogram of forces from the four centres. Again, the four-strand rope cannot be constructed without a supporting core, and since this is indispensable to its construction, its collapse must mean the dislocation of the whole structure, and as the core represents only about one-fortieth of the area, it may be reasonably assumed that the superior force exerted by the alternate contraction and extension of the spiral as the rope passes over the sheaves, must tend toward the breaking up of this core, the period of endurance being limited by its elasticity and the tension at which it is laid. This is what actually takes place.

Spiral Elongation

This will probably be the more readily grasped by referring to Fig. 2, which shows a three and four-strand rope in parallel, with the turns of one strand indicated by the figured lines. Thus the turns of the three-strand gradually gain upon the four in the proportion of one in five, or, in other words, six turns of the three-strand occupy the space of five turns on the four-strand, i.e., in ropes of the same thickness. The strand spiral of a seven-strand rope is nearer the straight line, being almost double the length of a three-strand rope.

It will, therefore, be acceptable that the medium engaging the greatest number of turns should prove to be the most resilient and more capable of disposing of the shocks and stresses set up, for instance, in rolling mill work, than any other. Again, as affecting the bending capacity of the rope, another important difference is observable—only two strands appear between every turn of a three-strand, while three occupy the spaces between every turn of a four-strand.

Longevity of Cotton Ropes

As to the life of cotton ropes, much, of course, depends upon their size and the conditions under which they have to work. All things being equal, durability may be gauged by sectional area, and the most economical diameters range from 1½ to 1¾ inches, more of the latter being use in England than any other size. For rolling mill work, however, it so often becomes a matter of sheave widths that 2 inch ropes are generally used. A remarkable case of longevity may be mentioned of twenty-four cotton ropes, 1¾ inches in diameter, employed to transmit 820 horsepower at a velocity of 4,396 feet direct from engine flywheel, 28 feet in diameter, in a Lancashire cotton mill. These were fixed in October, 1879, and are still running in 24-hour a day service, a period of over forty years. Another set has been working twenty-eight years on an average of 20 hours per day, and appear little the worse for wear.

Such cases of longevity lead to the conclusion that fatigue of material due to constant activity does not readily manifest itself in well-make cotton ropes. Their quick recovery from driving strain is suggested as the cause, since they pull down on the working side and bulge out to their normal diameter immediately upon passing to the idle or slack side of the drive.

English and American Systems

There are advocates of both systems

on this side of the Atlantic. We in England are almost exclusively under the English multiple system, and have little experience of the American continuous method. Our education, however, in this latter has been considerably advanced during the last six to ten years on this side, and it has been amply demonstrated that good cotton rope on the continuous system will pay for itself.

In England we are satisfied that the multiple rope system is the better in all-round practice. Immunity from stoppage is the most important factor, since it is seldom that more than one rope gives way at a time. The offender may be laid aside to await a favorable opportunity for replacement. An admission made to me by one of the leading authorities of the American system was that while all his experiments had been made with manila rope, he had the impression he could get still better results with a good cotton rope.

A drive has been erected for the Armstrong-Whitworth Company of Canada, Ltd., at Longueuil, Que., in which the sheaves are 108 inches and 72 inches in a rolling mill plant, with only 15 foot centres and grooves for twelve 1¾ inch ropes, which allows for only 7 feet 6 inches between rims. This drive was fitted under guarantee of maintenance from the ropemakers, who originally were consulted on the scheme.

Over Roping

Over roping certainly retards efficiency. The fault sometimes manifests itself by the slack changing with the pulling side, and at other times by the ropes travelling across the grooves or even leaving the pulleys altogether. When such troubles arise it is best to remove one or several ropes if need be without interfering with the splicing. Pass them over both pulleys and tie them well back to avoid revolving shafts. They can then be readily put back to work as the others give out. We have known instances where half the original number were taken off before satisfactory driving was obtained. This state of things frequently arises, even under fairly regular loads, when actual requirements come below the calculated power.

Over or Under Driving

While it is, and has been, generally accepted that the slack side of the drive should come on top, this position is not always obtainable, nor is it under all circumstances desirable. With an erratic or fluctuating load such as obtains in rolling mill practice, we recommend the slack to come on the bottom. The variable load of the mill tends to set up considerable oscillation in the ropes, and if the slack is above, may cause the ropes to ride or even jump off the sheaves. On the other hand, if the slack is below, any tendency of the rope to wander from its appointed track held very largely in check by the pull on the tight side, also gravity and the weight of rope will control the oscillations.

Rope Guards

If, however, ropes persist in wandering from their appointed track, we recommend the erection of a rope guard, in comb fashion, which should be placed approximately 10 per cent. of the centres away from the driven sheave. In rolling mill practice in England this is very freely adopted.

Sheave Diameters

Sheave diameters have a very important bearing upon the question, and while in England the minimum standard is taken as approximately thirty times the diameter of rope, in America forty to fifty times is accepted.

This, however, is largely a question of speeds to sheave size, as, for instance, a ½ inch rope will run comfortably over a 4 inch sheave at 1,000 revolutions per minute, a 1 inch rope over a 22 inch sheave at 3,000 revolutions per minute, and it is only when the speed rises to 5,000 feet per minute that we meet the thirty times rule for 1 inch rope.

Here, again, cotton scores over manila, since its softness readily admits of superior bending properties, while the native harshness of manila and almost entire absence of resilience compel a higher minimum sheave diameter to which ropes of this material can be bent over.

Centrifugal Force

Groove impact also acts in opposition to centrifugal force, which has proved so potent a factor in belt driving, that whatever is done by way of compounding with narrower belts, adhesive dressings, or squeezing out the inevitable air-cushion, it will assert its retarding influence at a velocity fixed roughly at about 3,000 feet per minute, when the power calculated on the basis of width must be discounted in proportion to the increase in speed.

As effecting the rope drive, however, many tables are compiled whereby a steady decrease of transmitted power over 4,800 feet per minute is shown, until we find ropes at 7,000 feet capable of transmitting only half the load of the same rope at 4,800 feet.

Effect of Moisture

Cotton ropes are also less susceptible to atmospheric changes than manila, for the reason that moisture more readily evaporates through the fibres, thus rendering them practically immune from internal mildew which so often is apparent in a discarded manila rope.

Inter-Stranded Cotton Driving Rope

Allowing the claims in favor of the three-strand rope, without further advocacy of the general principle involved, it may be logically contended that if such a rope possesses constant equality throughout, if the yarns are equal in counts, number, tensile strength and tension, each one following its appointed track without deviation, and are all of the best procurable quality, then we have arrived at a point bordering on perfection in the making of driving ropes, and their manufacture and application has been a close study for over fifty years.

This rope is made expressly for power transmission from the finest selected American yarns. Each of the three strands is made up of a succession of sheaths or layers of yarns, which may be peeled off until the centre thread is reached. The rope is machine built, under hydraulic tension, so that a perfect and combined tension is secured to each thread, from the moment these threads are led to the machine. The crinkling effect to be found more or less in all rope made by the ordinary method is thereby eliminated.

As previously mentioned, the triangulation of strains is secured in three-strand ropes, and in this particular rope is maintained to the individual threads. In effect this construction means that with the rope at work each thread takes its relative proportion of duty, and again in wearing only the external layer will show abrasion, leaving the next layer intact. This feature is of significant value, since there are many instances where, say, a 1¾ inch rope, after years of work, is reduced in diameter, but has still sufficient life left in it to enable it to be removed to a drive where ropes of about 1½ inch diameter may be in use.

There is no limit to length in constructing this rope other than may be controlled by convenience in transportation.

Splicing

All that has been said relative to the making of cotton driving ropes and their application to transmission of power would be of little value without some reference to the question of splicing.

This is so important to the well-being of the system in general that rather than have installations spoiled by indifferent workmanship expert splicing mechanics, properly trained to this duty, are sent out from England to all parts of the world. We have experimented with different devices of metal and other couplings, with a view to dispensing with splicing, but nothing has yet been found which, in England, would be considered against the long splice. This is usually calculated at about eighty-two times the diameter of the rope.

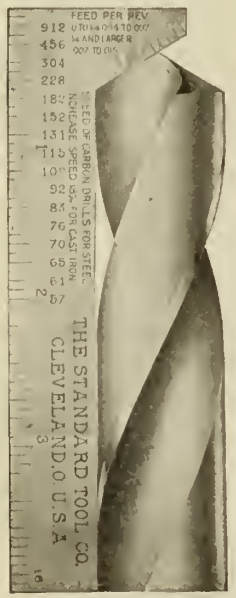
Can a Twist Drill Live up to its Reputation

It Can, and Will, if You Give It a Chance—Make Sure the Angle of Cutting Lip is Correct—See That the Clearance and Centre Angles are Right, Also Study the Data on What Will Happen if You Are Not Careful Enough

By H. WILLS

WHEN considering the precautions taken in the various operations in the making of a twist drill from the first laboratory test of the steel bars to the final inspection, it is a pretty safe conjecture that if a drill gives trouble some of the conditions surrounding its use should be investigated.

Twist drills will stand probably more strain in proportion to their size than almost any other tool, and a very large percentage of drill troubles could be eliminated were proper attention given to grinding the points. The form of the drill point controls the rate of production, accuracy of the hole, frequency



MEASURING LENGTH AND ANGLE OF CUTTING LIP.

of necessary grinding and the very life of the drill.

If the illustrations and instructions in this artiele are followed religiously, a uniform and satisfactory result will follow to an extent hardly appreciated by the average user of drills. In order to simplify the instruetions contained herein we suggest that users of twist drills be supplied with a drill grinding gauge chart of similar nature to that shown.

Twist drills must be properly ground and run at a suitable speed and feed in order to do their work efficiently. With the aid of such a tool a skilled workman ean attain the best results, this of course increasing the drilling production.

The tool as shown combines a gauge ground to an angle of 118 degrees and an accurate 4-inch scale graduated in 32nds and 64ths on one side and 16ths on the other. This gauge gives the proper angle and length of lip to the drills when they are being ground. The scale also contains a table of speeds and feeds

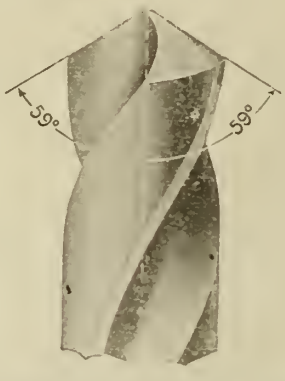


FIG. 1.—SEE THAT BOTH CUTTING LIPS ARE INCLINED AT THE SAME ANGLE.

for drilling steel and east iron. Opposite each ⅛ inch mark is a number showing the proper speed at which to run a drill of corresponding diameter.

Length and Angle of Cutting Lip

Make sure that both eutting lips are inclined at the same angle with the axis of the drill and of equal length. The point angle of 59 degrees has been universally adopted as best suited for average conditions, and the result is shown at Fig. 1. To properly grind a drill, proeeed as follows:

Correct Clearanee and Centre Angles

In this ease the drill point must have the proper elearanee or contour of surface back of the eutting edges and such elearance must be identieal on both sides. Approximately a 12 degree elearanee

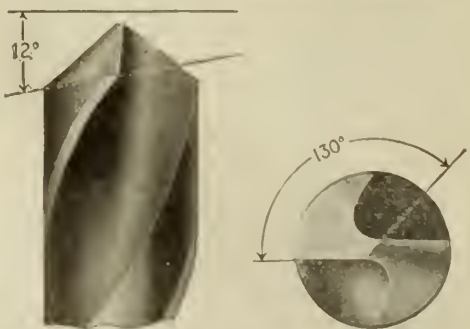


FIG. 2 AND 3.—WATCH THE DULL POINT.

angle, Fig. 2, combined with the centre angle of 130 degrees, whieh will give a constantly increasing clearance towards the centre, Fig. 3, has proven best for average conditions.

Incorreetly-Ground Drill Points

Some of the undesirable conditions resulting from drill points improperly ground follow:

When both lips are not ground at the same angle with radius, here is what happens. If both lips are not ground at the same angle with the axis, Fig. 4, one lip will fail to counteract the tendency of the other to spring away from the cut; consequently one lip will do more work than the other, which will result in its becoming dull more rapidly than if both lips were cutting equally, and it will be subjected to an abnormal torsional strain.

When Cutting Lips are Different Lengths

When the cutting lips of a drill have the same point angle, but are of differ-

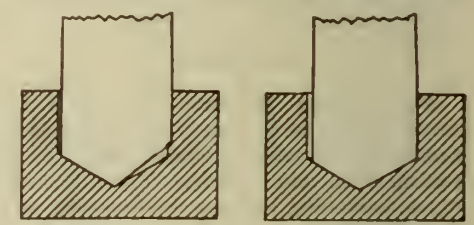


FIG. 4 AND 5.—POINTS TO WATCH.

ent lengths, Fig. 5, the point of the drill will be "off centre" or eccentric. As a result the hole will be oversize to an extent equal to double the amount of this eccentricity.

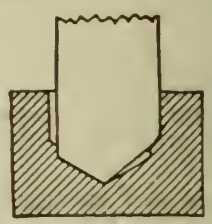


FIG. 6. WATCH THIS DANGER.

If the drill point is ground both with lips at different angles, and of different lengths, Fig. 6, there will be a combination of the undesirable results already deseribed.

Insuffieient Clearance at the Point or Centre

Fig. 7 shows a side and end view of a drill with the proper angle of point (59 degs.), and the proper angle of clearance at the periphery (12 degs.), but with

insufficient clearance at the point or centre.

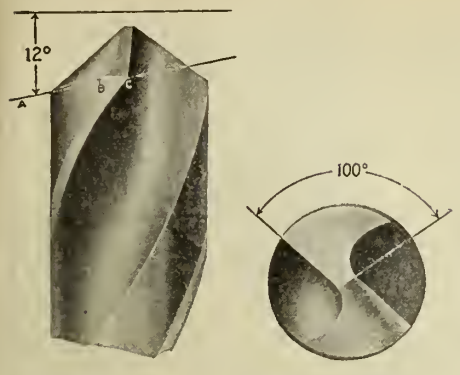


FIG. 7.—THIS IS A COMMON TROUBLE.

Fig. 8 shows a drill with insufficient clearance both at the periphery and at the centre. The line A-B-C is at an angle of 12 degrees, but there is no clearance immediately back of the cutting edges B-C, and the excess of clearance at the heel A-B is of no benefit.

Have You Experienced This?

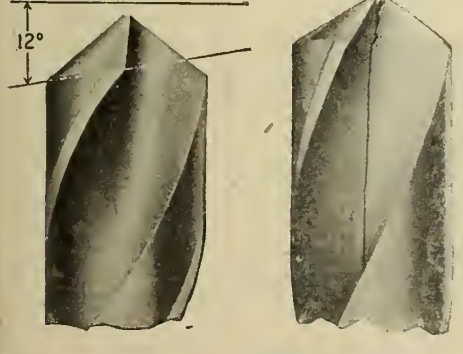
Fig. 9 shows what is liable to happen to a drill ground with insufficient clearance, especially if an attempt is made to obtain maximum production.

Fig. 10 shows a drill with a clearance angle of about 12 degrees but it does not have the proper contour back of the cutting edges. This manner of grinding leaves the cutting edges thin and weak, causing them to crumble away under heavy feeds.

Estimating Approximate Centre Angle

This gauge can also be used to approximate the centre angle. Although the included angle of the gauge is only 118 degrees, a centre angle of 130 degrees is recommended. The use of this gauge in the manner shown at Fig. 11 enables a very close estimate to be made.

Most twist drills are made with a gradual increase in the thickness of the web or centre of the drill toward the shank. As the drill becomes shorter



FIGS. 8 AND 9.—TWO COMMON TROUBLES.

and the web thicker, greater force is required to drive it. To overcome this, it is good practice to thin the web by grinding away the excess thickness, reducing it to its original dimensions. This grinding must not extend too far up the flute of the drill and care must be exercised that the cutting lips are not injured and that the same amount is ground out of each groove. Fig. 12 shows a drill with the web properly thinned. In Fig. 13 the grinding is excessive, leaving the web entirely too thin and liable to crumble. When this happens a split drill is practically inevitable.

Twist drills are made with a slight taper from point to shank so that the largest diameter is always across the corners of the cutting lips. This prevents the drills from binding in the work, when they are sharp. If the outer corners are allowed to become badly worn, the drills will bind and cannot perform satisfactorily. Whenever the outer corners of the cutting lips show wear, the drills should be re-ground and every particle of worn surface removed, or the drill will continue to bind and very quickly be damaged beyond repair.

In grinding high speed drills, care should be taken not to overheat them,

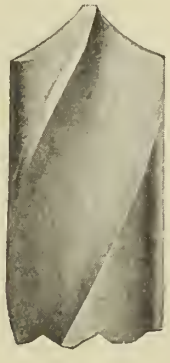


FIG. 10.—WATCH THIS DANGER.

and when heated they should never be plunged into cold water. Doing so is likely to cause small surface cracks, which reduce the efficiency of the drill and may result in serious damage to it.

Forcing the grinding on a wet grinder may also bring about the same condition.

If the suggestions for grinding drill points contained herein are followed and drills are run at the proper speeds and feeds, satisfactory results are practically assured. It is, however, hardly possible to do this grinding as accurately by hand as by using a good twist drill grinding machine, of which there are several on the market.

Broken or damaged tangs of drills are generally the result of an imperfect fit of the drill shank in its socket, which may be caused by a "worn out socket," "dirt or chips accumulating in the socket," or "bruises on the shank of the drill." In either case the driving power of the taper is reduced or destroyed, resulting in an abnormal strain being put upon the tang.

A drill of either carbon or high speed steel that can be filed is not necessarily

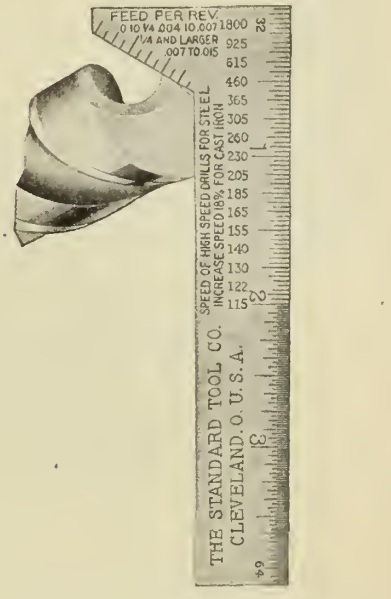


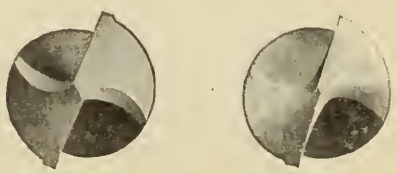
FIG. 11.—ESTIMATING THE APPROXIMATE CENTER ANGLE.

too soft for service; in fact, if drills were tempered so that a good file would make no impression, they would be entirely too hard for general use. If you have any doubt regarding the temper, try the drills in actual service.

Speeds and Feeds

There are so many conditions affecting drilling operations that it is extremely difficult to establish "hard and fast" rules for speeds and feeds. The tables given can be safely followed when drilling in commercial materials. Experience will enable the operator to determine what changes, if any, can be made from them. Assuming the drill is properly ground, when the corners of the cutting lips wear away rapidly it is an indication that the speed is too great. If the cutting edges roughen or break out in minute particles it indicates that the feed is too great.

In conclusion, let me say a word of caution regarding the use of very small drills. It is seldom that these are run at more than a fraction of the speed necessary to obtain the best results, and

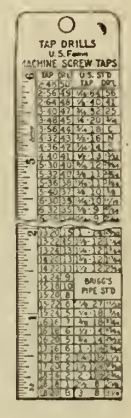


FIGS. 12 AND 13.—CORRECT AND INCORRECT THICKNESS OF WEB.

excessive breakage is inevitable. These are delicate tools; be sure they run true and that the cutting edges are kept sharp. A fine grade emery stone is best suited for this purpose.

Would You Like to Receive One of These Scales FREE?

You can easily do so and at the same time add to your store of knowledge by entering our weekly contest of which details are given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

CONTEST FOR DEC. 16TH ISSUE.

Contestants are required to write us, stating to which advertisements we refer to in this number.

1—Something that can be procured with or without a certain attachment.
2—What to use if accuracy is of the utmost importance.
3—A machine that uses a herringbone gear drive to the spindle.
4—How to show a vast improvement.
5—Something said to be of unusual purity.
6—How to keep a shop clean and at the same time reduce insurance rates.
7—Something said to be more economical than coal.
8—A product that claims to have winning features.
9—A product that uses no electricity, and gives you very accurate results.
10—An important factor in every contract job that can be successfully mastered.
11—Something that is said to be safe, economical, and efficient.
12—A product that possesses strength enough to stand up under hard usage.

Closing Date for This Contest is January 6th



WELDING AND CUTTING



The Welding of Locomotive Fireboxes

Full Welded Fireboxes, Semi-Welded Fireboxes, Semi-Welded Half Side Sheets, and Full-Welded Half Side Sheets Are Taken Up in This, the First Part, of Complete Article on Above Subject.

Compiled by J. H. M.

IT IS not often that one is able to state in concise form the experience of two experts, but in the article to follow, dealing with the welding of locomotive boilers, the data contained therein have been gathered by Messrs. Geo. L. Walker and R. T. Peabody, both of the air reduction engineering service department of L'Air Liquide Society. This matter was placed before those interested in book form by L'Air Liquide Society, and through their courtesy the author is now able to compile this material in the form best suited for our purpose.

The oxy-acetylene process has stepped very much to the fore in late years, and has proven of great value in the repairing of fire boxes and flue sheets, principally because the joints are perfectly water-tight, while the speed with which the work can be accomplished adds still more to its value.

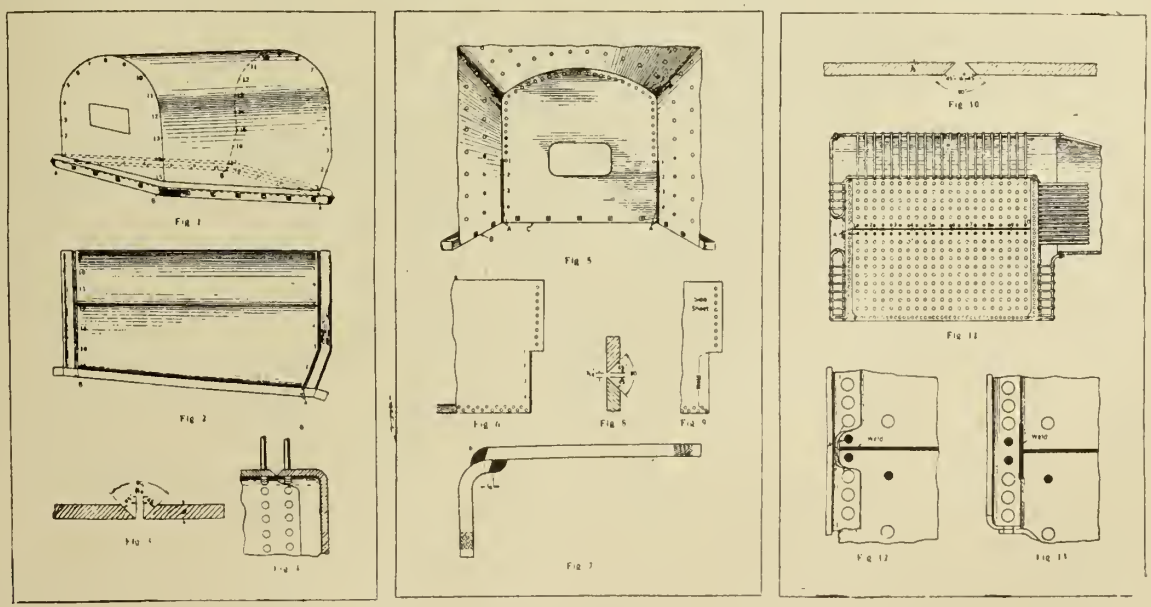
Failures have been recorded in the past but these have been traced to incorrect methods employed. This has been largely owing to inexperience on the part of the workman, or even utter lack of knowledge of the conditions. No one can make a success of welding until they become acquainted with the principles involved, choosing suitable apparatus, supplies, and so on.

General Instructions

The information to follow is given chiefly to assist the practical welder who might be or is working on locomotive boilers, and who is ambitious enough to read about what others are doing in that line. The methods advocated constitute the standard practices adopted by many railroad shops on this continent, and if carefully observed will ensure satisfactory results.

In the preparation of the work for welding, to ensure success it is necessary to observe five important things: First—The cleanliness of the sheets at welding seam. Second—That sheets are bevelled at a proper angle. Third—That sheets are in correct position. Fourth—That provision is made for expansion and contraction, and fifth—that you have suitable welding rods as filling material.

Before cutting a new patch, carefully inspect part to be welded and cut out all defective places, then cut only where there is a good foundation for the weld. When cutting out patches, carefully avoid cutting through stay bolts if possible. Do not under any circumstances cut out sheets or patches through old welds. For side sheets or three-quarter door sheets, extend new sheets at least one stay bolt higher; for crown sheet, one stay bolt lower; for patches, extend weld at least one row of stay bolts lar-



FIGS. 1 TO 13. INCLUSIVE.—TEXT DEALS FULLY WITH THESE EXAMPLES.

ger; for flue sheets, extend weld to one row of stay bolts lower.

When cutting out sheets or patches with cutting torch, cut them straight and bevel afterwards—preferably with a chisel. Clean surfaces are essential to good welding. Scale, rust, oil or grease must not be allowed to remain on the part to be welded, otherwise satisfactory welds are impossible. The most satisfactory angle for bevelling plates is an angle of 45 deg., making between the two plates an angle of 90 deg., or a right angle. All sheets and patches must fit with an opening of from ⅛ in. to 3-16 in. between patch and sheet all around—never less than ⅛ in. and never more than 3-16 in.

The welding of cracks in side sheets, door sheets, fire doors, crown sheets, bottom and top of flue sheets should not be attempted, or only resorted to in cases of extreme emergency, to be corrected at the very first opportunity. Welding cracks in barrel of boiler, welding over stay bolts and welding stay bolts is not allowed under any circumstances.

Welding of Full-Welded Fireboxes

A full-welded firebox is one which has all of its joints welded instead of riveted. The welded joint, to the investigator's opinion, is stronger, more economical, will not leak, and has more durable expansion and contraction properties than the riveted seam. The welding should be performed as follows:

First place the firebox upon the mudring A B A B, Fig. 1, and bolt it fast. Next, prepare to weld the outside, or water side, of say the flanged flue sheet to the firebox, as shown at Fig. 2, by cutting a bevel of about 45 degrees all the way along its edge from mudring to mudring. Now bevel the matched edge of the firebox in like manner. The best practice is to make the flange of the flue and door sheets so as to include a row of radial staybolts. See Fig. 4.

After this set the firebox so that the weld joint remains open at its bottom about 3-16 in., Fig. 3, allow for expansion, to clinch the welding metal and insure a perfect weld through the vee. Start the joint by welding it for about an inch just above the mudring, say at 1, Fig. 1, using 3-16 in. or ¼ in. Swedish iron welding rod, and a good welding blowpipe with suitable tip. From a point about 10 in. up from the mudring weld downward from 2 to 1. Then, continuing the method, weld from 3 to 2, from 4 to 3, and so on. This practice will prevent the spreading of the joint from unequal expansion. Add enough welding rod to raise the surface of the weld about ⅛ in. above the original metal. If practicable, a second welder should follow the outside welder and smooth-flow the joint on the inside while it is red hot. This will be certain to make the joint tight.

Working from the inside, weld the firebox to the mudring at the corners A and B, Fig. 1, then weld on the door sheet the same as the flue sheet.

Welding Semi-Welded Fireboxes

A semi-welded firebox is one on which welding is substituted for riveting along the lower vertical joints of the flue and door sheet with the side sheets. This practice is followed where it is desired to avoid riveted joints in the fire zone, and some shops also weld the bottom horizontal joint of the firebox and the mudring for about 12 inches both ways from each corner. The chief advantage of this welding is the elimination of leakage. The work should be done as follows:

First bolt the firebox to the mudring and rivet the flue and door sheets to the side sheets down to within about 36 inches from the mudring. Omit the rivet holes along the corner joints to be welded from 1 to A, see Fig. 5. Also leave out temporarily the rivets next to the top of the joint at 1, Fig. 5.

PREPARING WORK

To secure a successful weld, you must first prepare the work properly. There are five important things to observe, viz., the cleanliness of the sheets at the welding seam, that the sheets are bevelled at proper angle, that they are in correct position, that provision is made for expansion and contraction, and that you have suitable welding rods for filling material.

Next prepare the side sheets as shown in Figs. 6 and 9, but cutting into the flange about ⅝ in. so that it can be set down flush. Butt the joints and bevel both edges at about 45 degrees on the outside of the firebox. Leave a 3-16 in. opening at the bottom of the vee as shown. Some welders have used a lap weld like that shown at Fig. 7, but it does not make as strong and tight a joint. The butt weld as shown at Fig. 8 is the best for such work.

The next step is to tack-weld the flange at 1, see Fig. 5. Use a good welding blow-pipe for this purpose, making sure you have a suitable tip, and a good grade of welding rod.

Starting on the outside at about 10 inches below 1, weld from 2 to 1. Then from 3 to 2, and 4 to 3. Complete the joint by welding on the inside from A to 4. Weld the other three corners in like manner. If a second welder is available the metal should be flowed on the inside while being made.

Welding of Semi-Welded Half Side Sheets

Semi-welded half side sheets are those which are welded along the horizontal joints to the crown sheets, and are riveted to the mudring at the bottom and to the door and flue sheets at the ends. The welding of the long seams should proceed as follows where the door and flue sheets have not yet been set.

First proceed to bevel the edge of the half side sheets and the corresponding edge of the crown sheet as shown at Fig. 10. Next screw in the second row of staybolts and bolt the sheet to the mudring before starting to weld. To avoid delay, all of the staybolts, except the rows adjacent to the weld may be screwed in and set, and the side sheets riveted to the mudring before the welding is done.

On this being completed, weld about 2 inches of the joint at 1, Fig. 11, then, beginning at 2, about 10 inches from 1, weld back to 1, from 3 to 2, and so on to the end of the joint. Use a good welding blowpipe, with suitable tip, and as before, make sure a good grade of welding rod is used. The door and flue sheets should now be riveted in.

If the side sheets are to be put in after the door and flue sheets have been set, the flanges of the door and flue sheet should be heated and raised as shown at Fig. 12. This will allow the part of the joint under the flange to be bevelled.

When the new door and flue sheets are put on, the adjacent rivets A, see Fig. 12, should be left out until the welding is completed.

In Fig. 13 is shown the practice of welding the end of the long seam when it is desired to change an old riveted joint to a welded one. The vertical weld should be carried to the second rivet each way.

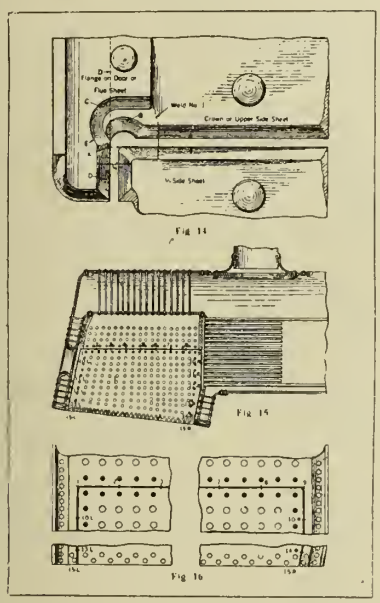
Full-Welded Half Side Sheet

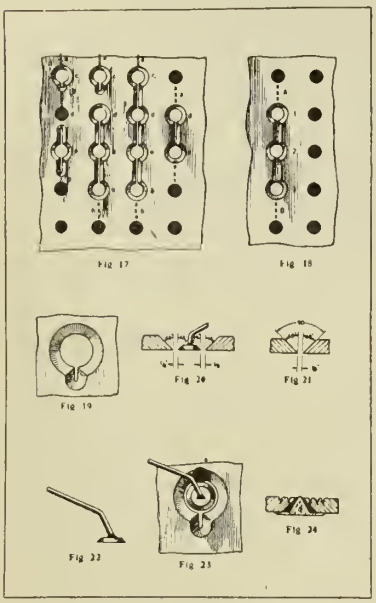
A full-welded half side sheet has no riveted joints at the top or sides, all three edges being welded. The work should be performed as follows: Cut out the flange of the door or flue sheet next to the joint of the crown and half side sheets, as shown at A and D, Fig. 14. Then bevel the flange, including rivet hole C, and set it flush with the half side sheet. Next bevel the crown sheet, including the rivet hole B. Now set the side sheet so that a ¼ in. space is left at its top and sides, and then bevel those edges. If this sheet is not riveted to the mudring, bolt it fast. Screw in and set all staybolts except those next to the welds.

Now weld the horizontal seam for about 1 in. at 1, as shown at Fig. 15. Then from point 2, about 10 in. from 1, weld back to 1, and from 3 to 2, continuing until the joint is completed. Next start about 10 inches down the vertical joint of, say, the door sheet at 10L and weld up to 1, see Fig. 15. Then from

10 inches below 10L and 11L weld back to 10L, from 12L to 11L, and so on to within a few inches of the mudring.

Weld the flue sheet joint the same way as the door sheet, from 10R to 9, see Fig. 15, from 11R to 10R down nearly to the mudring. Weld the bottom of the joints to the mudring at 15L and 15R last. When the flanged joints of the door and flue sheets are in good condition, but the rest of the plate needs renewing, a good job may be performed by setting in the half side sheet, as shown in Fig. 16. It should be tacked at 1. Then weld from 2 to 1, 3 to 2, and so on, following the practice described above.





FIGS. 14 TO 24.—FURTHER EXAMPLES. SEE TEXT FOR DESCRIPTION.

Welding Cracks In Side Sheets

Cracks in side sheets between staybolt holes are not easily welded, because of the difficulty of making proper allowances for expansion of the metal. In fact, if a side sheet has many cracks like those shown in Fig. 17 it would be better to put in a new sheet rather than resort to welding. Much welding of side sheets is being done, however, and the following method may be successfully used when the staybolt holes are to be closed:

To weld a crack like that at Fig. 18, bevel the sides of the hole and crack, as shown in Fig. 19. Prepare for each hole a soft steel disc about 3-16 in. thick and of say ¼ in. smaller diameter than the hole. Bevel the edges of the disc, as shown in Figs. 20 and 21. Melt a piece of welding rod to the disc to serve as a holder, hot-bending the rod, as shown in Fig. 22.

Next place the disc in the hole and melt down the upper edge a, see Fig. 23, to tack the disc in position. Preheat the metal between the two holes at xxxA, Fig. 18, and keep it red hot. Melt off the rod and complete the welding of the disc into the hole. Now allow the hot section xxxA to cool with the weld at 1. This provides for uniform shrinkage. Weld hole 2, Fig. 18, in the same way, and then weld the crack from 2 to 1. Preheat the section xxxB when welding the last hole of that line. The weld should be reinforced, as shown in Fig. 24.

In some cases where it is not practicable to replace a badly cracked side sheet by a new one, or put on a patch, the welding may be done as follows: Referring to Fig. 17, preheat the top of the left row of holes at xxxa. Then weld in hole c of this row. Preheat the area xxx down to d, as well as that at xB. Weld the crack at the bottom of the hole e of the first row, then the staybolt hole e, the crack at the top of this hole, and finally weld the joint around the head of the staybolt d, which is assumed to be in good condition. Reheat the area xxxa to relieve the shrinkage strains, and let the job cool down before proceeding with the other rows.

Weld the last row on the right next by preheating at xxxa, filling the holes at d and e, and then the crack between them. Reheat the lower part of the row at xxx, and allow the whole job to cool uniformly. Now weld the second row from the left in the usual way, and allow the sheet to cool again. Weld the third row from the left last, which is done in this case because it is the longest continuous crack.

MICA AND ITS USES

Mica is one of the most useful minerals, the production and distribution of which is little known. Of the many varieties, only three are of commercial importance, and of these but two are available in any quantity—the muscovite, or white mica, and the phlogopite, an amber mica. The latter is the most important of Canadian micas.

India is the largest producer of mica, providing over 50 per cent. of the world's supply. Canada produces about 25 per cent., and the United States and other countries the remainder.

In Canada, mica occurs pretty generally. The most productive areas are situated along the lower St. Lawrence below Quebec, north of the Ottawa near Mattawa, and in the townships of Burgess in Leeds county, Lanark in Lanark county, and Loughborough in Frontenac county, also in a few areas in British Columbia. The production of 1919 was valued at $273,305.

Mica mining is attended with many difficulties. For successful exploitation it is essential that the miners be experienced in the mining of this material, and be familiar with the special conditions and problems it presents. Many good mica deposits have been abandoned on account of the lack of experience of the operators.

The general run of mine mica is of a small size. A very small percentage produces sheets of 4 x 6-inch surface, while fully 50 per cent. will cut to 1 x 3 inch sheets only. Fortunately, a process of cementing the small sheets enables the building up of larger surfaces. This product is known as "micanite" or "mica board" and is mostly used in the electrical industry for insulation. Mica is largely used in the manufacture of boiler and steam pipe covering, its insulating properties exceeding by far that of any other known substance. Comparative tests have demonstrated that the loss of heat from bare pipes has been reduced by 90 per cent. when the pipes were enclosed in mica covering.

Owing to its resistance to shock, mica is used for spectacles or goggles worn by workmen in industries where flying chips or sparks endanger the eyes, and in observing processes of melting and fusing in furnaces. The small pieces of mica, formerly wasted, are now used for various purposes. When ground fine in oil, mica forms a valuable lubricant, especially for shafting or journal boxes on locomotives or railway cars. Ground mica, when mixed with a flux, is also used in giving to wallpaper and other substances a silvery effect.

So many uses are being found for mica that what was formerly an industry with a very large proportion of waste is now one in which the material is almost completely utilized.

W. Stuart Cooper, a commercial traveller with a wide knowledge of trade conditions in the West Indies, is now in Canada for the purpose of further developing trade between the two countries. Mr. Cooper intimated that trade conditions in the islands are steadily improving, and emphasized the fact that an increasing desire for Canadian trade is evident. Mr. Cooper has established his headquarters in Montreal, with offices at 401-403 Sun Life Building.



DEVELOPMENTS IN SHOP EQUIPMENT



RADIAL DRILL

The Niles-Bement-Pond Co., with general offices at 111 Broadway, New York, have placed on the market a new line of radial drills, which are termed right line radial drills.

These machines embody many radical changes, and the drive has been greatly simplified so that a higher percentage of the horsepower is delivered to the spindle. The design also gives increased rigidity, greater convenience of operation, and wider adaptability.

The feature that is perhaps the most decided departure and that adds to the rigidity of machine and simplicity of the drive is the patented double column. The design of this column is clearly noted from the illustration accompanying the article.

The column is a single casting formed of two box section members cast integral at the top and bottom, the arm saddle being mounted between them. This construction permits the simplest and most direct drive from the motor to the spindle. The motor is mounted on the back of the arm saddle and drives the spindle through a single horizontal shaft running between the column members, two-thirds of the usual driving gears and shafts being eliminated.

Column of Beam Section

Since the column is not of the stationary type but rotates with the arm, it has been possible to place the metal to the best advantage in the form of a patented beam section which is much stiffer than a circular section of the same weight. Furthermore, the bending stresses in the column are always in the direction for which its section is designed. In order to give additional support to the column, the trunnion or circular part extends through to the bottom of the base.

Another advantage of this type of column is that it permits the use of V-type tracks at the front and back for guiding the arm saddle. When clamped by means of a wedge action on these tracks, the arm and column form a rigid unit. The column can be instantly clamped rigidly to the pedestal by means of a motor operated device. Its simplicity and convenience are shown in the illustrations. The operator need not leave his working position at the drill, as the clamp is engaged and disengaged by simply throwing a switch located on the drill head. A lever for clamping by hand is also provided.

The clamping mechanism consists of a hinged conical ring acting on the column trunnion. When the ring is contracted by hand or power, it pulls the column flange down firmly to the pedestal.

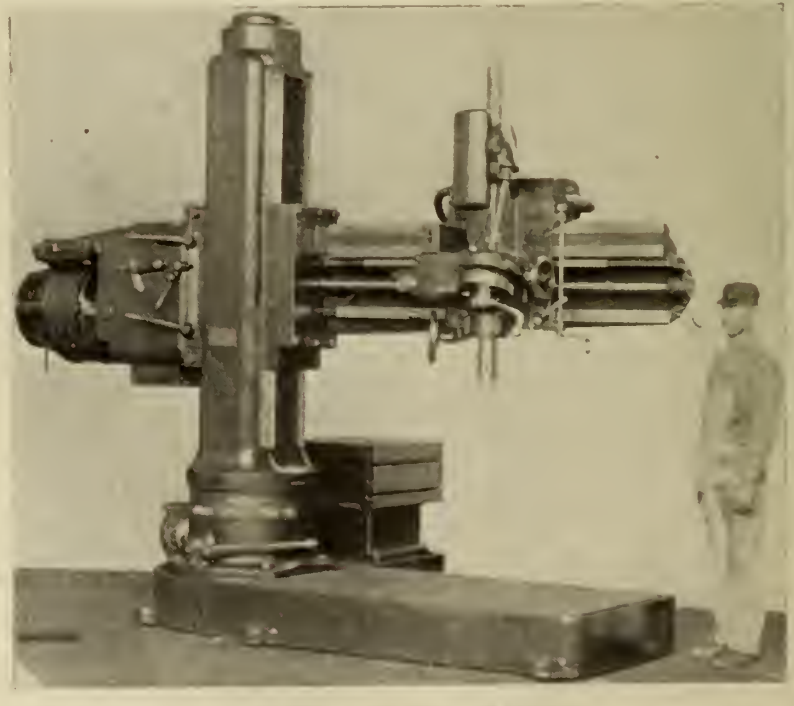
The electric clamp is operated by a small motor through worm-wheel and nut. The mechanism is self-adjusting, wear being taken up automatically. As this clamp is operated by electricity instead of air, it uses the same source of power as the driving motor. Therefore, when installing these machines, no consideration need be given to a compressed air supply.

The arm is especially easy to swing, the entire weight of the arm and column being supported on a ball bearing at the bottom of the column, in addition to which any side thrust is taken on two roller bearings. When the clamping mechanism is relieved, special springs lift the column a few thousandths of an inch so that the column flange clears the pedestal. Friction at this joint is thus eliminated and the arm and column turn entirely on the ball and roller bearings.

The arm is of a new patented section and is especially designed to give greater resistance to the drilling pressure. The most important features are an upper narrow guide for the saddle and the lower bearing set in a plane back of the front surface. This construction brings the driving shaft closer to the spindle and gives a greater depth from the front to the back of the arm; therefore, for a given amount of metal, the arm is much stiffer than arms of the usual designs.

The arm is raised and lowered by power from the driving motor operating through the stationary elevating screw and a revolving nut in the arm saddle. The mechanism is engaged by throwing the clutch lever located on the driving gear box and is started and stopped by the controller handle on the drill head. The elevating and clamping mechanisms are interlocking so that the elevating mechanism cannot be engaged until the clamp is relieved nor can the arm be clamped until the elevating mechanism is disengaged.

Another valuable feature on these machines is the automatic stop to prevent accident or damage to the machine, should the operator carelessly run the arm to the limit of its travel at either the top or bottom. This device also stops the arm in case the arm or spindle strikes an obstruction in lowering.



GENERAL VIEW OF THE DRILL.

The elevating screw is hung at the top of the column on a friction ring. When the arm reaches the top or bottom of its travel, the revolving nut comes in contact with a pin on the screw causing the screw to turn and thus bringing the arm to a stop. When the spindle or arm meets an obstruction in lowering the elevating screw is lifted and turns freely, thus stopping the arm.

Spindle Drive

The most important advantage of the double column construction is that it makes possible a drive so simple and direct that there are only four gears and one double-faced pinion from the motor to the spindle. The power is transmitted direct to the spindle by a horizontal shaft running through the column and is applied at the lower end of the spindle, as close as possible to the drill.

The gears for direct drive consist of two spur gears at the motor end and two bevel gears and an intermediate double-faced pinion in the drill head. The back gears are located in the gear case next to the motor and run in oil.

The motor controller is located on the head and the spindle is started, stopped, reversed or varied in speed by a convenient lever.

The spindle counterweight is geared directly to the spindle and is supported at its centre of gravity to eliminate friction and binding on the guides.

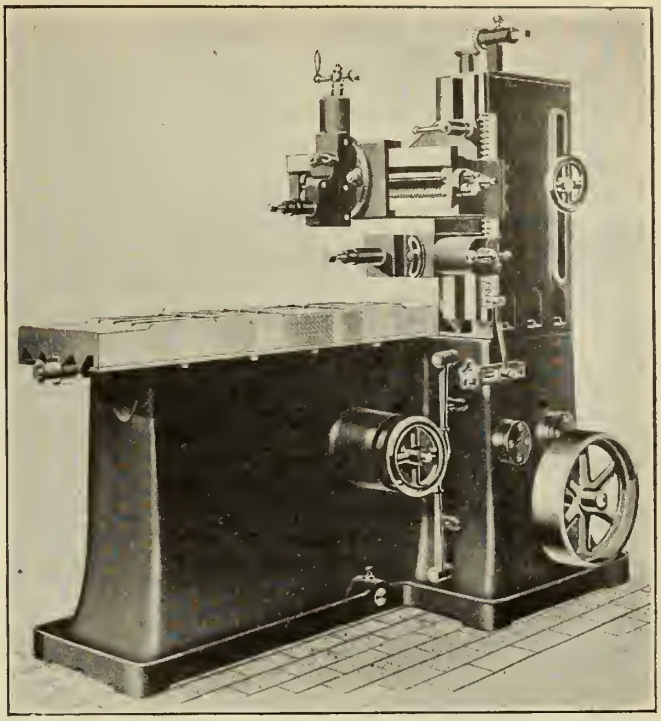
The range of the feeds and speeds is sufficient to take care of any boring ordinarily required of a radial drill, in addition to drilling and tapping. There are eight positive geared feeds which are changed by means of a disc, graduated to show the feed for each position. The feed change gears are entirely enclosed and run in oil. They are so constructed that they can be taken out of the head as a unit.

UNIVERSAL SHAPER

The Universal Machine & Tool Co., Canton, Ohio, have placed on the market what is known as their 24-inch Universal Shaper. This machine combines various features well worth describing.

The machine is claimed to fill the gap between the shaper and planer, and is said to be able to handle work of awkward shape. The ram stroke has been replaced by a speedy table stroke, and the natural lifting tendency of the ram is replaced by the action of the universal table, giving as high as 40 strokes per minute.

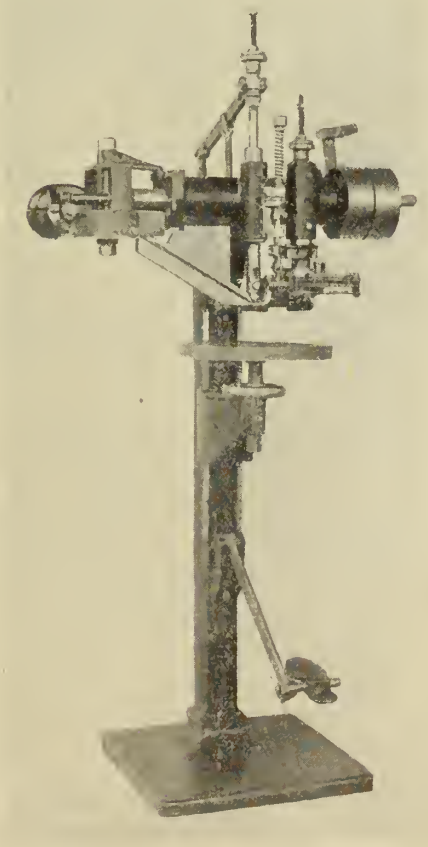
Four speeds are controlled by two levers on the operator's side of the machine, these giving speeds of 7, 20, 30 and 40 strokes per minute. All operating levers are placed on the operator's side, and with the open side feature it is possible to clamp long work to the table without obstructing the operator. The machine is of rugged design and is said to be capable of taking an extremely heavy cut. It is single belt driven, has power feed to head and saddle, and all shafts run in ball bearings.



GENERAL VIEW OF THE SHAPER.

SCREW DRIVING MACHINE

The Reynolds Machine Co., Massillon, Ohio, have developed a machine that sets and drives small screws in place, thus speeding up light assembly work. Some of the applications to which this machine is suited are in driving electrical binding screws, switch box screws, washer head screws, etc.



GENERAL VIEW OF THE SCREW DRIVING MACHINE.

This concern has hitherto built machines which automatically feed and drive screws of ordinary proportions, but this new machine handles screws having a length less than the diameter of the head.

In operation, screws are thrown at random into the magazine at the right of the machine. This magazine automatically arranges them in single file with heads upward and delivers them in this position into the inclined track shown leading from the magazine. Opposite, and closing the lower end of the track is a finger recessed to receive one screw and hold it in line with the spindle. The spindle, which carries a screw driver bit, is brought down by the foot lever, the bit engages slot in screw head and finger and screw are carried downward until the point of screw engages work, when the finger is automatically withdrawn to allow the screw to be driven home.

The spindle is adjustable frictionally driven so that screw driver bit stops when screws are driven as tight as desired, or screws can be merely started, or driven to a uniform depth. Table is twelve inches in diameter and is adjustable on column to take up to fifteen inches high and has screw for close adjustment. Foot lever is pivoted well above the pedal to give an easy swinging position, and can be adjusted both for position and resistance to suit convenience of the operator. Operation of machine with foot lever leaves both hands of operator free to handle or assemble work. Spindle may be run several hundred R.P.M., setting screws practically instantly, and the machine is driven with tight and loose pulleys as shown, or with individual motor.

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A Good Time To Buy Tools

RIGHT now is a good time to buy in the machine tool market. That may be a peculiar remark, but it is a fact.

You can get service now that you could not possibly get six months ago, and which you may not be able to get six months from now.

Many of the larger makers announce that they will protect buyers in the matter of price decline, so there is nothing to be afraid of in this respect.

Buyers should take advantage of the fact that it is a buyers' market now. They accuse the sellers of taking advantage of the situation when the tables turn and the market becomes one that is dominated by the sellers. Why, then, would it not be good business for a buyer, when a buyers' market turns up, to go in and make the very best bargain he can? He certainly can talk with greater freedom now than he could a year ago. The situation is here and it is all in his favor.

It may be that we are facing another situation like the one that followed the close of the war. Every person stopped still for a few weeks. There was no particular reason for it, but it happened just the same.

Right now we are in a similar place. People are stopping. There is no good reason for it. We have not had a crop failure—we have not had a panic, neither are we facing another war.

It all seems to be because our dollar is growing bigger when we come to spend it. It is worth more now than it was three months ago when we take it out into the markets and exchange it for the things we need.

If you are a prospective buyer right now should be a good time to go in and talk to the machine tool dealers about your requirements. You will find that they have time to talk to you, and give you good attention. You may find that you can buy to advantage. It is worth trying. We are not going to stay where we are for very long and the first thing you know it will be turning around again to a sellers' market and you will have to take what you can get and stand in line for some months to secure it.

Picking War Plants To Pieces

RUNNING stories of how United States wasted money in the war is getting to be a favorite subject with a good many papers.

For instance, investigation shows that the Government let 111 contracts to the amount of $478,828,334 for the construction of artillery of all calibres, guns, howitzers, gun carriages, limbers and recuperators. Of this immense programme of expenditure there reached the American troops and were actually used in combat 39 75-millimeter anti-aircraft mount trucks, 48 4.7-inch guns of the 1906 model, 48 4.7-inch gun carriages of the same model, 24 8-inch howitzers and 24 8-inch gun carriages.

Then for the turning out of explosives the expenditure ran into the millions, while the explosives ran into nothing at all. In fact, the amount of explosives and gas from the United States war shops that ever reached the front was very, very small.

It might be possible to go ahead and deliberate upon this waste and extravagance at great length, but look at the other side. Take a few of the cases right around here. It might be possible to go up to the splendid Leaside plant in the latter days of the munitions manufacturing when they were getting tuned up to turn out the 12-inch shell, and say "Look at all this plant here, fine machine tool equipment, great shops and layout. All this and no production."

Again it might be possible to go to Motor Trucks at Brantford, when a large building for this purpose was put up at an abnormally high cost, and look at that place. There it was, hundreds of thousands of dollars' worth of equipment being rushed in there and put in position, work going on at feverish haste in order to get that one thing most necessary—production. Did they get any? No, they did not. As far as we know that great plant never turned out a cent's worth of shells.

Well, it would be a very simple matter to go to that plant and say, "Look at that for waste. A great steel structure in the first place. All rigged up with the best of equipment, all heated, power transmission machinery there. A big organization and yet not a cent's worth of output to be put over against all that expenditure." And that charge would be perfectly true. And yet it would be just as unfair as it is true.

No doubt much of the dust that is being kicked up in United States could be traced to the same source.

In this country firms were not sorry that they lost their production. Any such feelings were swallowed up in the joy at the war coming to a close.

War is a waster, and the waste is not confined to operations at the front, nor to the districts in which battles are fought. War plants were largely wasted afterward. They were not put up for commercial pursuits, neither were they erected with the idea of competing with any other plant afterward. They were rushed up for a purpose, regardless of expense, which was in many cases very high when compared to days when things were done on a competitive basis.

It is hardly a fair thing to put a peace-time analysis to things that were done in the feverish haste that characterized much of the war work.

Chas. M. Schwab, Optimist, States His Views

CHARLES M. SCHWAB, speaking in New York a few days ago, gave some plain talk to those who are afraid of the present situation. To quote Mr. Schwab's own words in this matter:—

"But I want to go on record here as saying that nothing could be healthier for American business than the very condition through which we are now passing. It had to come. I only wish it had come sooner. The severer the storm is now, the quicker it will be over and the sooner we can emerge into clear weather and shape our course upon the sea of prosperity.

"Business in the United States ever since the war started had been, until very recently, upon a false basis. The disposition of many manufacturers had been to say not: 'Let me see your costs sheet,' but 'Let me see your statement of profits.'

"Now the true test of success in business is not profits, but economy. Profits may be the result of good fortune, of a fleeting period of inflation, of temporary conditions of any kind, but a business structure which is built simply upon the profit sheet of the moment is built upon the sands. The only business foundations which are sure and steady are erected upon the rock of economy.

"The result of this experience through which we have passed is that our costs have been inflated and we have had in America both our business institutions and American individuals generally indulging in wasteful and extravagant methods.

"The supreme virtue of the existing situation is that it is compelling every business man in America, in fact, every individual in America, to examine thoroughly his costs of doing business and his costs of living. The result of it all is to force business and to force individuals to start to economize and to save.

"I hear men say that the greatest need of the hour is the liquidation of labor. In saying this many have in mind the high wages now being paid to labor and industry, and mean that labor must adjust itself to a new standard of living.

"Now the laboring man is primarily interested not in the amount of money paid to him, but what his money will buy. If the cost of living comes down there is no question that our American laboring man can maintain his present standard of living even though his wages as stated in dollars amount to a lesser sum than before.

* * *

"In the steel industry one-half the total cost of making steel is the cost of labor. You can, therefore, see how important efficiency and labor costs are in all items of manufacture.

"The laboring man is entitled to his full share for the contribution he makes to the value of an article. The laboring man should be taken into the fullest confidence of his employers. He should be so sure of getting his fair share of the wealth he produces that he will work with zeal and enthusiasm.

* * *

"The world during the past few years has been a spendthrift and a waster. It has spent its life and its blood in prodigal living. It has spent a large part of its liquid wealth and has now come to a period where it can go forward only by energy and effort of the most vigorous kind.

"When, therefore, our business men thoroughly study and cope with these problems of economy and make up their minds to go ahead and to produce to the utmost on a smaller margin of profit than they have been accustomed to realize in the years of inflation, then our course will have been set toward a haven of safety and progress.

* * *

"At the moment, our export trade hangs by a slender thread. The exchanges have been moving altogether too much in our favor. We are rapidly getting into the position where the whole world owes us money and yet cannot pay it. We have recently seen a little cloud on the horizon out in North Dakota. Certain farmers owed the bankers money. The value of the produce which secured the loans went down below the value of the principal. The bankers called the loans and the farmers could not pay. This process has resulted in closing something like twenty small banks in North Dakota during the past few weeks.

"The whole world owes the United States money and the whole world is hungry for the things the United States can supply. Not quite a year ago, one of our great financiers returned from Europe and suggested that we create a revolving fund of $500,000,000 to finance the absolute requirements of Europe and start the countries in distress on their way to self support. Perhaps he did not state the correct sum, but for lack of our ability to sell to Europe through having sufficient credit available, the value of the farm products of this country, which Europe would like to buy, has decreased during the past few months not hundreds of millions, but billions of dollars.

"If the business of the United States is to go forward as it must go forward, our people must take a world view. We must think internationally. We must trust in the good faith and in the productive power of Europe, sending to them our raw materials and goods to enable them to resume productivity, and accepting in payment therefor securities representing their productive activities."

Appointed General Manager

C. R. BURT, M.E., has been appointed general manager of Willys-Overland Co., Weston Road, Toronto. Mr. Burt is no stranger to this country, having been connected with the Russell Motor Co. for some years. He is a thorough mechanic, as well as a capable plant executive. Starting as a boy, he was an apprentice with Brown & Sharpe, Providence, R.I., where he remained for twelve years, being sent by that company in 1900 to Europe to study conditions and practice there.



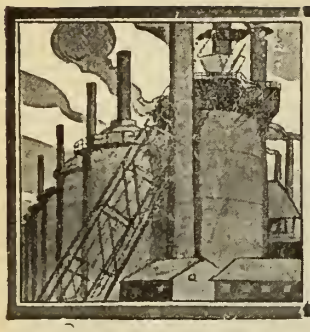
C. R. BURT.

A few years later, he became connected with the Barber-Colman Co., at Rockford, Ill., makers of gear cutters, etc. While engaged at this plant Mr. Burt designed and perfected the Barber-Colman gear hobbing machine.

It was in 1913 that Mr. Burt came to Canada as factory manager of the Russell Motor Co., and the following year he was appointed assistant general manager and given a place on the board of directors. In this year he made another trip to Europe for the Russell Co., to look into conditions of trade and motor car practice in general.

Shortly after this the munitions contracts started to come to this country and Mr. Burt had much to do with the successful operation of the big munitions plant put up and operated by the Russell Motor Company.

"Iron Age":—To sum up, certain readjustments of past periods of depression that required time for completion are not needed now, while the readjustments that are needed to-day are theoretically unending, cannot be pursued to their end because they have none, and hence will not be pursued indefinitely. We may be able to resume work, therefore, and on an intelligent and safe basis, in a shorter time than many new seem to think is probable.



MARKET DEVELOPMENTS



Some Bright Spots Seen In The Dull Market

Dealers Report Some Good Orders, but Markets are Mostly Quiet With Little Trading—Independents May Move to Cut In on the Corporation Prices if They Can Get Business

A FEW nice orders were secured in the machine tool market during the week and these provide the bright spots. Otherwise trade was not up to the mark. Several of the principal makers have notified their agents that they will protect buyers against price declines for the coming six months. Buyers do not seem to be taking advantage of the fact that it is a buyers' market now, and they could probably come in with their requirements to much better advantage than at any time during the past three or four years.

Local warehouses have announced new prices on some lines. Bar iron and bar steel are selling at 5c base. Sheets and plates were also put on a lower level. There is a fairly large stock of sheets in store, quite enough to take care of the present requirements of the trade. Manufacturers still send out lists of surplus material on hand, and the peculiar situation is found at times of the dealer trying to sell the manufacturer the very materials that the manufacturer would like to see the former taking off his hands for resale.

One of the largest dealers in scrap metals notified some 3,000 firms during the week that for the present they were entirely out of the market as far as taking on anything in the line of brass, copper, zinc, lead, spelter, etc., is concerned. In fact they are out of the whole non-ferrous line, and in iron and steel they are buying only against contracts. This is the first time in the history of their business that they have sent out such notices. They intend to keep out until something definite is established as a working base in the metal market. During the past month they have had to write off some hundreds of thousands by way of depreciation on stock in their yards and warehouses.

BRIGHT SPOTS SHOW UP IN THE WEEK'S BUSINESS IN MONTREAL

Special to CANADIAN MACHINERY.

MONTREAL, Dec. 16.—The varying reports of fairly good trade and dullness from dealers and agents, makes it difficult to state, definitely, what the actual market conditions are at the present time. Intermingled with the usual statement that business is more than seasonably quiet, one is confronted now and then with the information that activity is even above normal. One steel and heavy hardware firm here, during the past week, has had exceptionally good business of late, and reports that the present period compares very favorably with corresponding weeks of previous years, barring the abnormal demand during the years of the war. However, business in general is comparatively quiet, but in the opinion of many is more the result of bank regulations than that of actual trade requirements. Business today is temporarily diverted to retail aetivity, and for the next two or three weeks will overshadow other lines of endeavor, but with the turn of the year the prospects appear good for a gradual return of general industrial and commercial enterprise.

Waiting For The New Year

No outstanding features have developed to alter the general quiet condition of the steel market. There is little doubt that American mills are doing their best to induce buyers to come into the market owing to the depleted condition of the mills' order books, but the recent declines have, as yet, failed in doing this to any great extent. The existing demand is not such as would call for any keen competition, for if it was so, it is thought that prices would show a more rapid decline. Local trade shows no change from that of last week, the movement being light but fairly regular. It is anticipated that price quotations here will be revised about the beginning of the year, when it is expected that activity will show a gradual, though perhaps slow return to that of several months ago. Plate movement has eased up a little, and likewise sheets, although galvanized lines are none too plentiful.

Anticipating Good Business

While few dealers are denying the slackness of trade and the hard efforts that are necessarily required in obtaining sufficient orders to keep things going to the extent of "just paying the way," the majority of the tool dealers in this district have a cheerful note to sound when speaking of next year's business. There may be nothing of a tangible nature to warrant this attitude, apart from the fact that the needs of industry, in the way of increased equipment or replacements, while apparently adequate for a curtailment period through which we are now passing, are nevertheless insufficient to maintain even normal operations, should trade suddenly return to former activity. Dealers report fairly good business in the lighter supplies but admit a slight falling off from previous weeks. Some little business has been done in used equipment but sales of new machinery, particularly of the heavy variety, are few and far between.

No Interest In Scrap

Dealers are almost indifferent to the present situation, fully believing that

nothing of a special character will develop this month to change the market from the listlessness through which it is now passing. Price, apparently, is not the obstacle that must be surmounted, as any reduction in scrap quotations fails to bring other than casual inquiries. As long as retrenchments are the order of the day, with industrial production being curtailed in many quarters, the consumption of scrap is reduced to a minimum, and consumers will not buy more than they actually need to carry them over the immediate present. At the same time dealers are not anxious to accumulate yard supplies, so that the result is one where inactivity is the dominating feature. Some of the steel scraps have been reduced. Boiler plate, heavy melting steel, malleable scrap, and stove plate, show a decline of $2 per ton. Wrought iron pipe has declined from $9 to $8.50 per ton.

SOME GOOD SALES ARE BEING MADE

But in the Main the Machine Tool, Iron and Steel Market Continues Quiet

TORONTO.—It would be wrong to get the idea that there is no business in the machine tool market. There is a certain amount of selling, and the tools being sold are good sized ones, involving in several cases a pretty fair sale price. Dealers say that buyers are not asking much about the prices. Several of the larger firms have gone this far—they are protecting their buyers in the matter of price for the ensuing six months—that is, if in that period the price is put to a lower figure than that paid by the purchaser, he is entitled to a rebate of the difference.

One of the dealers seen this morning has just returned from a trip to several of the centres, and he is of the opinion that there is not going to be a return to pre-war prices, but that the values will find their new levels fairly well above the old prices. "There were firms in the machine tool business that never made enough out of it to grow as they should. I can think of several that have always turned out a good product, and almost at any time they have been ready to throw up their hands and quit because they never made enough to see them through rough spots. Not only that, but there is a pretty well fixed belief that the cutting of prices would not bring any more purchasers into the market. We are quite satisfied to go ahead and sell on the present lists, feeling that we are getting just as much business as though we had a new and considerably revised schedule."

Although nothing definite has been announced it is felt that the automobile firms will be getting under way, probably on a small basis at first, around the beginning of the year, and they are looked upon as likely to have some pretty fair inquiries to attend to. Taken as a whole, the machine tool business is quiet, but there are bright spots, and the trade in general is not in a mood where it is complaining.

POINTS IN WEEK'S MARKETING NOTES

Steel ingot production in United States for November was 15 per cent. less than in any of the corresponding three months.

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Independent steel mills are shortage of business, several of them operating at the present time at not more than 60 to 70 per cent. It is generally conceded that it does not pay to run a mill much under 70 per cent. of its capacity.

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Pittsburg believes that the next market development will be cutting of Corporation prices by some of the Independents. The big question is whether such practice would bring them any business.

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The production and sale of pig iron is in smaller quantities than for some time past. Foundry iron is quoted at several places at $33 and $35.

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Several machine tool firms are announcing that they are willing to protect buyers against price reduction for a period of six months.

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Some very nice orders have been secured during the week by machine tool firms, although on the whole business is still quiet.

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Several lines of steel were marked down in warehouses this week. Bar iron and steel are now selling at 5c base. Black sheets are quoted from warehouses at 9c.

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There is still a good demand for boiler tubes and there is a complete range of these in stock at most of the steel merchandising warehouses.

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The largest scrap metal dealer in this district has sent out word to some 3,000 customers that for the present his firm does not intend to buy any non-ferrous metals. They will not take these lines at any price, while dealing in iron and steel is still at a very low ebb.

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Some of the scrap metal dealers have found it necessary to write off some hundred of thousands of dollars in the last few weeks, owing to the depreciation of stocks in their yards and sheds.

Steel Market Easier

Several prices were marked down at local warehouses this morning. Steel and iron bars are now selling at $5 base. Steel plate is quoted in most cases at 6c. Sheets are to be had for 9 cents for 28 and 7.50 for No. 10. Galvanized is selling around 11.50, and is none too secure at that figure.

Very few of the warehouses are taking in sheets now. In some cases they claim to be well enough stocked to run along now for three months. Fortunately prices are mixed enough to enable most of them to keep pace with the decline in prices. There are still some sheets in stocks that were taken in at high prices, and these, put in with shipments of lower priced goods, makes the present price. There are still a number of manufacturers who have a certain amount of surplus material which they are trying to unload. In fact there have been cases where a dealer was trying to sell the same line to a manufacturer that the latter was thinking of trying to sell to the dealer. There is not sufficient quantity of this in the market to make any serious difference in prices. The market seems to be pretty well filled with sheets for present requirements.

Tubes are fairly active, and there is a good assortment in several of the warehouses. Bar mill products are not moving very rapidly.

Preparations are being made in some of the warehouses for getting in shape for renewed buying after the first of the year. Some of the dealers believe that we are passing through a period much the same as that which came shortly after the war, when there was a lull in trade for a short time, to be followed by a period of keen buying. Were such a situation to develop it would result in stiffened prices, as there are no large reserves.

Out of the Market

There is nothing in the scrap metal trade to indicate that dealers are looking for a revival before long. One of the largest yards stated to Canadian Machinery: "We are sending out notices to over 3,000 firms that we deal with stating that until further notice we will not take on any non-ferrous metals under any consideration. We cannot see our way clear to keep in the market at any price until something happens to settle the schedules for dealing and give us some reason for believing that we are down to the bottom in the matter of prices. It looked for a short time at the start of the week that the market was going to gain strength, but just at the moment when this looked possible both New York and London went weak,

and the thing was off. This is the first time possibly in the history of this firm when we have absolutely and positively left the market in any particular lines. We are out on the non-ferrous lines until something definite is established either up or down."

"And how about the iron and steel end of it?" was asked.

"Little better, but not much. Foundries are not buying, and the steel plants are not taking on a pound. We are not cutting the prices any lower, but it would be well for you to make it very plain to your readers that the prices quoted for old material are purely nominal. We would not undertake to pay any of them unless we had some place where we were going to place the material at once."

It is understood that some of the yards have had to write off very large amounts in the past few weeks, running into a good many hundreds of thousands.

NEW YORK MARKET IS STILL VERY DULL

And a Number of Used Machines Intended for Export Are Offered At a Price

Special to CANADIAN MACHINERY.

NEW YORK, Dec. 16. — Business in machine tools is exceedingly quiet and will doubtless remain in this condition until after the first of the year. Some of the railroads and other large prospective buyers indicate that their purchases will be made after January 1, but just how early in the new year they will act is not known. It is believed in some quarters that the volume of buying which may be done by the railroads in 1921 is exaggerated. Officials of the roads point out that a good many of the contemplated purchases must be financed out of current surplus profits, and with a decline in freight movement it is not apparent that there will be any large surplus profits in the next few months even with the present high freight rates. Moreover, if money is borrowed by the railroads for such large purchases as locomotives and cars a lower money rate will be necessary. There has been a slight easing in the money rates, but not enough as yet to encourage any large borrowing.

There are varying opinions as to when a revival of machine-tool buying may be expected. Some in the trade put off the time until spring.

In the next two weeks a large number of machine-tool plants will shut down for periods ranging from a few days to two weeks. This will afford an opportunity for annual inventories and for repairs to shop equipment. In practically all plants working forces and the number of working hours have been reduced. Some companies are virtually without orders and are making a few tools for stock. However, the amount of manufacturing for stock that will be done under present high costs is apt to be exceedingly limited.

Buying of used tools is more active than the market for new machines. A considerable number of new machines is being offered for sale at concessions in prices, these machines in most instances have been bought for export. Owing to cancellations from abroad the exporters are obliged to offer the tools for sale here.

CONDITIONS IN THE BUFFALO MARKET

Steel and Iron Trade Is Down to the Level of New Quotations

Buffalo.—A further curtailment of production by blast furnaces and steel plants in this district amounting to possibly 50 per cent. of the previous scale of production is announced.

One large mill has suspended steel operations altogether.

Three out of four blast furnaces operated in connection with this interest are banked. Another large steel-making interest is operating about 50 to 60 per cent. Four out of nine blast furnaces are down and the open-hearth equipment has been partially closed. Another steel-making plant is operating about 75 per cent. This plant is operating its two blast furnaces. Two other furnaces are operating from 75 to 100 per cent.

Local mills have not published a lowered schedule conforming with present Steel Corporation and Jones & Laughlin prices, but their price policy is practically one of conformance. They state that future orders will be figured on individually, and special prices made. This policy works out to what is tantamount to the corporation schedule. One maker here has taken several orders for bars, plate and structural. The price on the bars is 2.35; shapes, 2.45, and plates, 2.65.

Pig iron sales just now are light with resale continuing to make the market. About 1,000 tons in all have been sold in the past week. This iron is being sold at various prices. Some of it is sold as low as $37; some at $38 and $40 for the base grade at foundry.

CORPORATION MILLS ARE STILL OPERATING CLOSE TO CAPACITY

Special to Canadian Machinery.

PITTSBURGH, Dec. 16.—Production of steel ingots in the United States was about 15 per cent. less in November than in either of the three months preceding, which had shown substantially the same rate. The Steel Corporation's production rate was fully maintained, while the independents had a decrease of about 28 per cent. It is possible that the Steel Corporation's output increased somewhat, and if so the independent output decreased by more than 28 per cent. The estimate of independent production is based upon the November report of the American Iron and Steel Institute. These monthly reports show the output of 30 companies, producers having 15 or 16 per cent. of the capacity not making reports. As the non-reporting producers are independents and as there is a great difference now between Steel Corporation and independent operations the report must be analysed and an allowance made for this fact. The tonnage actually reported shows a decrease of 13 per cent. for November.

The decrease in independent steel production has been continuous since the latter part of October and thus the present rate is far below the average of November. The common prediction is that by the end of this month the independents will be very largely idle, many plants closed and others operating at only 50 to 70 per cent.

The Steel Corporation's output is, if anything, increasing. The corporation has blown in several additional blast furnaces in the past few weeks, not because it did not want to operate them previously, but because it has only lately been able to secure enough coke, partly because there had been a shortage of cars in the Connellsville region and partly because the by-product plants, at the blast furnaces, could not get sufficient coal.

Steel Corporation's Orders

The unfilled obligations of the Steel Corporation at the end of November are reported at 9,021,481 tons, showing a decrease during the month of 815,371 tons, against decreases of 537,952 tons in October, 430,234 tons in September, and 313,430 tons in August. Previously, for 14 months, there had been increases.

While the November decrease in unfilled tonnage seems large, the showing is really a very favorable one to the Steel Corporation in view of general conditions. The decrease represents about 61 per cent. of capacity, but shipments were probably about 89 per cent. of capacity, and thus the net bookings were about 28 per cent. of capacity, net bookings being the difference between total bookings and the cancellations, for doubtless even the corporation had a little by way of cancellations. The average independent, on the other hand, had scarcely any bookings, while most of them had heavy cancellations, and undoubtedly many independents would show for November a loss in unfilled tonnage actually greater than the shipments.

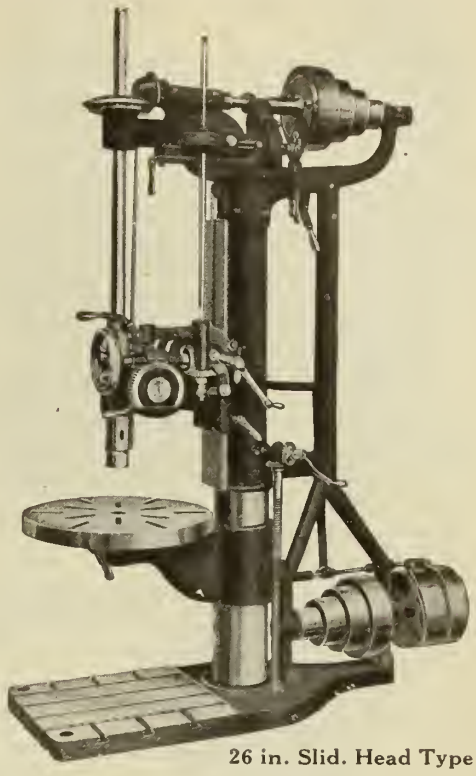
The 9,021,481 tons of unfilled obligations at the end of November is equal to the corporation's output for over seven months at 90 per cent. of rated capacity. Of course the business would not keep the corporation operating at that rate for

A Complete Line 8 in. to 50 in. Swing
with or without tapping attachment

BARNES

Upright Drills
Horizontal Drills
Gang Drills

Accuracy—Strength
Convenience of Operation



26 in. Slid. Head Type

Carried in Stock by

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seven months, since some of the business is strung out over longer periods. The corporation is, however, in a very comfortable position. The tables are turned, as compared with the time when the independents, on account of their much higher prices, were making much larger profits per ton than the corporation.

Market Stagnant.

The semi-finished and finished steel markets remain absolutely stagnant. It is probably no exaggeration to say that never has the steel market been so dull. That does not mean that consumption is at an unprecedently low ebb, by any means. The consumption is being supplied chiefly by the Steel Corporation on its old orders. The corporation has about 44 per cent. of the capacity and is shipping at the rate of about 90 per cent. of capacity. The steel shipped is doubtless all going into consumption, and there is still some production by independents.

During the period of steel scarcity there was much reference to the Steel Corporation making sales and shipments only to "regular customers." A quite erroneous view of the situation would be formed if it were assumed that the buyers of steel are divided simply into two classes, customers of the corporation and customers of the independents. A great many buyers patronize both the corporation and one or more independents. In such cases the corporation allotted steel to the customer and the customer covered his remaining requirements outside. Now, in many cases, the amount the consumer gets from the Steel Corporation is sufficient, because the requirements have decreased.

This situation must be taken into account in weighing the predictions made in most quarters that there is likely to be a mild revival of buying just after January 1. The prediction is based on the perfectly correct premise that steel consumption never ceases, that even in the poorest times in the past there has been consumption equal to 50 to 60 per cent. of capacity. If the Steel Corporation operates full that takes care of a very large part of the "hard times demand." Then it is to be considered that the country's steel capacity has increased about 50 per cent. since 1914 and it is not yet proved that the normal consumptive demand is increased in that same proportion.

Steel Prices

As noted in previous reports, tin plates, bars, shapes, plates, wire products and sheets have come to show an independent market at the Steel Corporation level. The independent market that began about a year ago is ended. Pipe, however, remains an exception. The independents are still on their 54 per cent. list, the Steel Corporation having maintained the 57½ per cent. list of the Industrial Board. The difference is about $7 a net ton. However, some of the independents were formerly obtaining large delivery premiums, beyond their regular prices.

The common view is that the next market development will be shading of. the Steel Corporation's prices by some, perhaps many, of the independents. Certainly there would be a disposition in that direction, if the operation seemed to be worth while. It is all a question of whether a mill could secure enough business by cutting prices to make an economical operation. Some of the independents used to claim that their costs were so high that they could not afford to sell at the Steel Corporation prices, but of course they included overhead in their cost. If the mill is idle the overhead is lost anyhow. On the other hand, it is not feasible to operate a mill at a very low rate, that entailing a greater rate than closing entirely. Thus, unless a mill can get enough business to operate at 60 or 70 per cent. for at least a week or two at a time it is unlikely to try to get business at all.

Pig Iron

Furnaces continue to go out of blast. There is no inquiry for pig iron and furnaces are making no effort to force sales. The foundry iron quotation has dropped from $37 to $35, valley, Bessemer and basic remaining quotable at $35 and $33 respectively.

Germany and Belgium Are After Business

Making a Strong Bid to Win Back the Connection With South Africa—Many Lines in Which Canadian Makers Might be Interested for Their Export Business are Mentioned Here.

GERMANY and Belgium are both actively engaged in their efforts for the South African trade in iron and steel, including bar iron, iron wire and tools. In barbed wire, 12 gauge, 100 pounds per gross, barbs six inches apart, the present offers from Germany are 35s 3d c.i.f. Cape Town.

In such tools as pincers, pipe wrenches, punches and other items similar to those of which German samples are shown at the Department of Trade and Commerce, Exhibits and Publicity Bureau, in Ottawa, shipments are coming in fairly freely from Germany. Occasion has been taken to see several invoices of shipments on open indents, the items on which were taken from the old 1913-14 catalogues. The several buyers interviewed point out that although open orders were placed it was only the articles which German manufacturers knew would be competitive that were shipped; in other words, no advantage was taken of the open order.

The present prices of the German tools referred to are an increase over their 1914 prices of 175 to 225 per cent.

Provided that the quality is satisfactory and the prices and terms competitive, a good business could be worked up in Australia in such lines as twist drills, reamers and milling cutters, grinding wheels, drop forged spanners, taps, dies and screwing tackle, files, vises, forges, drills, metal thread screws, and power transmission appliances; also electric house supply meters.

Australian requirements in the twist drill line are confined to carbon tools. There is a big demand for high speed tools. American prices are usually found in excess of British prices. United States manufacturers do the largest business, though Canadian houses get a portion of the trade. Business in grinding wheels is almost entirely confined to United States makers. A large and growing business is being done and the opportunity is good to participate.

The United States houses are strong competitors in the drop forged spanner business. There is an exceedingly good opening in this line but care should be taken that the right articles are supplied.

For many years traders looked to North America for their supply of files, but many merchants have turned to British supplies. There is no reason, however, why Canadian manufacturers should not obtain a share of the business. At present the largest line of taps, dies, and screwing tackle comes from the United States, which has a strong hold on the market. Canadian manufacturers, however, who will supply good tools, which are interchangeable, and of good quality, at competitive prices are assured of good business.

There is a ready sale for vises, forges and blacksmiths' drills, and Canadian manufacturers should give their attention to Australian markets.

Metal thread screws, bolts, etc., are largely used by stovemakers and motor car body builders, as well as in general engineering and standard Whitworth threads are used.

A large number of pressed steel pulleys, hangers, compression couplings, etc., are imported, but Australia makes her own wood pulleys.

There is a large demand for electric house supply meters, as great difficulty has been experienced in obtaining these for some time past.

To obtain business in any of these lines it is necessary to appoint a representative. English and United States houses are well represented, and it is almost useless for Canadian manufacturers to try and obtain business otherwise.

Developing Steel Plant

Since the Broken Hill Proprietary Co. opened its steel works at New Castle, near Sydney, Australia, in 1915, 637,213 tons of pig iron has been produced, while the output of the steel plant has been 593,223 tons. The demand for their products is so great that it has been found necessary to add to the present extensive premises. It is expected that the proposed new plant will cost £3,500,000. The extent of the company's output has enabled a number of new and important industries to spring up, the latest being for the establishment of a wire netting industry which is expected to start operations next year. When the new furnaces are running it is expected there will be an output of 450,000 tons.

The importation of agricultural machines into Czecho-Slovakia is at present prohibited, but licenses for limited quantities are granted to co-operative societies and other importers for the purchase from abroad of machines which are needed and cannot be produced in Czecho-Slovakia. The rate of exchange is a great obstacle, so that if importations were unrestricted the turnover would not be large as the price to the farmer would come high.

Another Market Here

Bohemia, Moravia and Silesia before the war offered a market for certain lines of machines and industrial equipment, such as spinning machines and other textile machines, paper, machinery, etc. There is a considerable manufacture of machinery in Czech-Slovakia and the present policy of the government permits only the purchase of machines from abroad which cannot possibly be obtained in the country. Import licenses for textile machinery from Great Britain has been refused, but certain special machines have been admitted. When the industries of the country are on a more normal and independent basis it may be expected that the trade restrictions will be modified.

Grain harvesting machines are manufactured to some extent in Czecho-Slovakia, but not so as to preclude the necessity for importation. The United States and Canada formerly supplied the bulk of mowers, reapers and binders, and importers are again looking to these countries for supplies. The low exchange value of the crown and import restrictions hinders business at present, but on the other hand, there is a lack of these implements and also a lack of agricultural labor and importations from abroad will soon be necessary. Canadian firms should now prepare the ground for future business by getting in touch with importers and co-operative agricultural societies.

Tractors and motor ploughs are another line of agricultural machinery which offers openings for future trade from abroad, home production does not cover the demand.

Prague is the most important centre for the trade in agricultural machinery and implements, while as a distributing point for Slovakia the town of Bratislava (Pressburg) also promises to be important in the future.

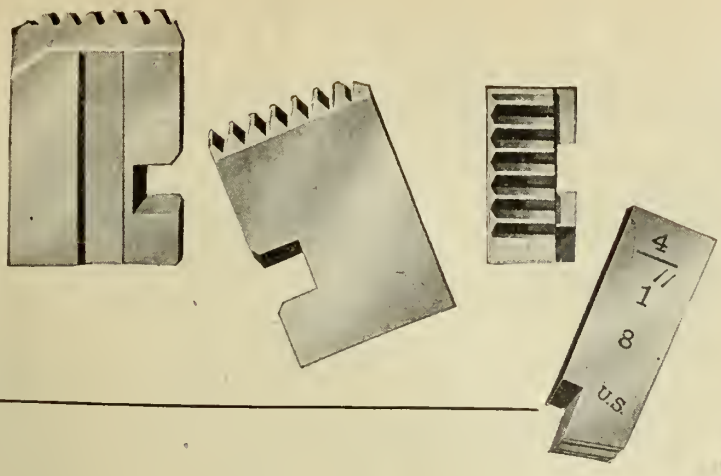
SCRAP METAL MARKET

The prices on the scrap metal market still continue to lower. The consumers continue out of the market.

The outstanding feature of the situation in scrap iron on the Chicago market is the increasing tonnage being offered by railroads which may be partly due to the wild weather, which makes it possible to gather and sort this material at a season when the cold and snow usually prevents it.

Sharp reductions are the outstanding feature in cast scrap and iron car wheels on the New York market. Iron car wheels have been sold as low as $24 f. o. b. New York and heavy machinery cast at $25 and $26 respectively. This is a reduction of $5 to $6 and in the other grades of $3 and $4 respectively.

The business on the Philadelphia market is confined mostly to forced sales and trading among dealers. The continued absence of buying is bringing further drops in scrap prices. Heavy melting steel has been bought by dealers at as low as $15.50 delivered.



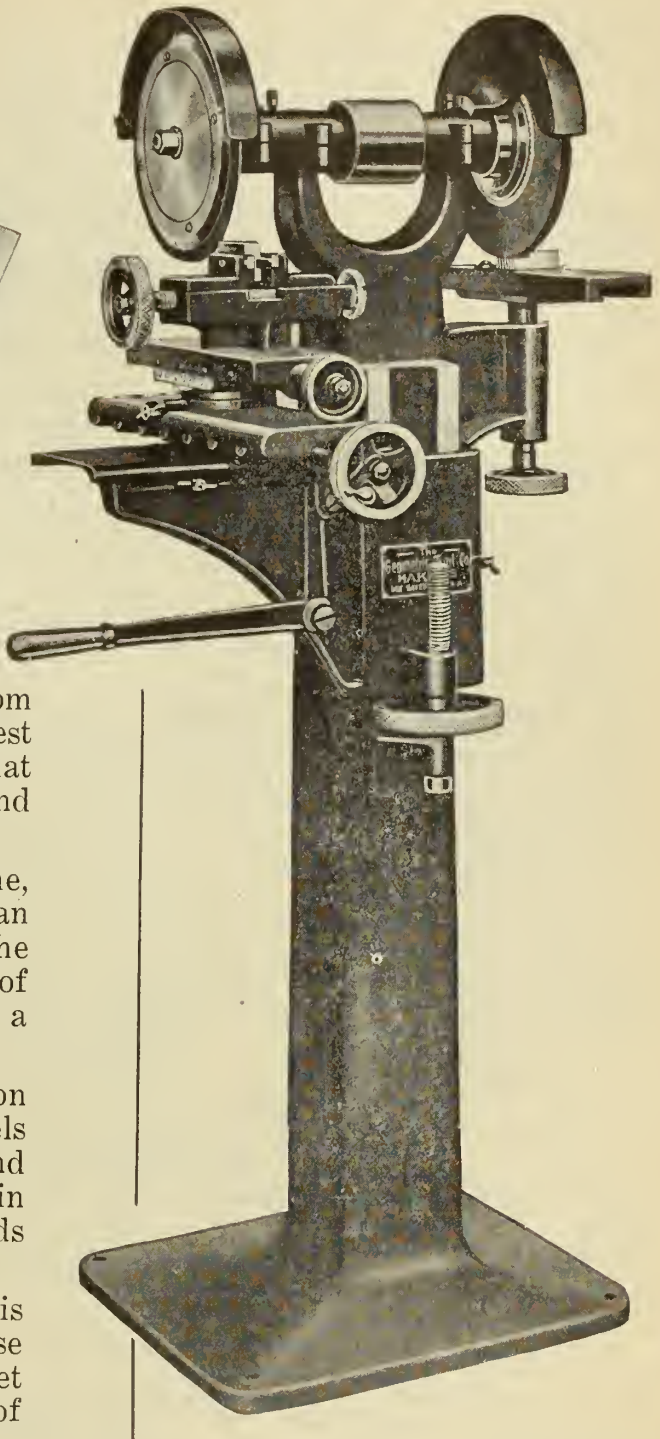
Sharp Chasers Cut Clean Threads

Accurate, uniform threads result only from chasers which are maintained in the highest state of cutting efficiency. This means that chasers must be kept sharp, and ground uniformly.

Even if just touched up from time to time, the chasers respond splendidly, with clean threads. And with this machine — the Geometric Chaser Grinder—the matter of keeping threading tools up to scratch is a comparatively simple matter.

Various makes of chasers can be ground on this adaptable machine. The two wheels permit the easy grinding of both milled and tapped chasers. In addition, the plain wheel lends itself readily to various kinds of tool grinding.

Uniform grinding of a set of chasers is purely a mechanical matter through the use of adjustments which can be accurately set to govern the grinding of an entire set of chasers.



The Catalogue describing this machine is a mine of information on chaser grinding. Write for it.

THE GEOMETRIC TOOL COMPANY

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Candian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta
Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Toronto, Winnipeg, St. John, N.B., Halifax, N S.

If interested tear out this page and place with letters to be answered.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$39 96
Lake Superior, charcoal, Chicago.	53 50
Standard low phos., Philadelphia.	44 79
Bessemer, Pittsburgh	41 96
Basic, Valley furnace	37 50
Toronto price:—	
Silicon, 2.25% to 2.75%	51 50
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 00
Steel bars, base, Toronto	5 00
Iron bars, base, Montreal	5 00
Steel bars, base, Montreal	5 00
Reinforcing bars, base	5 50
Steel hoops	6 00
Tire steel	5 00
Spring steel	8 00
Band steel, No. 10 gauge and 3-16 in. base	5 50
Chequered floor plate, 3-16 in.	8 50
Chequered floor plate, ¼ in.	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	3 50
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	5 50
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 67 to 5 50
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	58½	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

METALS

	Gross. Montreal	Toronto
Lake copper	$19 00	$19 50
Electric copper	18 50	19 00
Castings, copper	18 00	19 00
Tin	44 00	46 00
Spelter	8 50	9 00
Lead	7 50	8 00
Antimony	8 00	9 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 6 50	$ 6 00
Plates, ¼ up	6 00	5 50

PIPE—WROUGHT

Standard Buttweld Pipe

Per 100 Ft.

	Steel Blk.	Steel Galv.	Gen. Wrought Iron Blk.	Gen. Wrought Iron Galv.
⅛	$ 6 50	$ 8 50	$.....	$.....
¼	5 31	7 41	5 91	8 01
⅜	5 31	7 41	5 91	8 01
½	7 10	8 63	7 95	9 48
¾	8 80	10 87	9 95	12 02
1	13 01	16 07	14 71	17 77
1¼	17 60	21 74	19 90	24 04
1½	21 04	25 99	23 79	28 74
2	28 31	34 97	32 01	38 67
2½	44 75	55 28	....	....
3	58 52	72 29	....	....
3½	74 06	90 62	....	....
4	87 75	107 37	....	....

Standard Lapweld Pipe

Per 100 Ft.

	Steel Blk.	Steel Galv.	Gen. Wrought Iron Blk.	Gen. Wrought Iron Galv.
2	$32 01	$ 38 67	$35 71	$42 37
2½	48 26	58 79	54 11	64 64
3	63 11	76 88	70 76	84 53
3½	75 90	92 46	85 10	101 66
4	89 93	107 55	100 83	120 45
4½	1 05	1 29	1 30	1 54
5	1 22	1 50	1 52	1 80
6	1 58	1 95	1 97	2 33
7	2 06	2 53	2 53	3 01
8L	2 16	2 66	2 66	3 16
8	2 49	3 07	3 07	3 64
9	2 98	3 67	3 67	4 36
10L	2 77	3 41	3 41	4 05
10	3 56	4 39	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger, 50%.
4" and under, running thread, 30%.
Standard couplings, 4-in. and under, 30%.
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$10 50	$10 50
Copper, crucible	13 00	12 00
Copper, heavy	12 50	12 00
Copper wire	12 50	12 00
No. 1 machine composition	13 00	12 00
New brass cuttings	7 00	9 00
Red brass turnings	10 00	10 00
Yellow brass turnings	7 00	7 50
Light brass	5 00	5 00
Medium brass	6 50	6 00
Scrap zinc	5 00	5 50
Heavy lead	5 25	5 60
Tea lead	2 50	3 00
Aluminum	16 00	16 00

	Per Ton	Gross
Boiler plate	$11 00	$12 00
Heavy melting steel	18 00	23 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	20 00	25 00
No. 1 machine cast iron	32 00	33 00
Pipe, wrought	8 50	10 00
Car wheel	30 00	33 00
Steel axles	20 00	20 00
Mach. shop turnings	8 00	9 00
Stove plate	23 00	25 00
Cast boring	8 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	+10
Carriage bolts, ⅜-in. and less	Net
Coach and lag screws	—15
Stove bolts	55
Wrought washers	—25
Elevator bolts	+10
Machine bolts, 7-16 and over	+10
Machine bolts, ⅜-in. and less	+10
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 50
Nuts, hex., tapped	add 3 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent.
Set screws —20% 25 and	5
Sq. and hex. hd. cap screws	12½
Rd. and fil. hd. cap screws	plus 25
Flat but. hd. cap screws	plus 50
Fin. and semi-fin. nuts up to 1-in.	12½
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	—5
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	+12½
Studs	+5
Taper pins	—12½
Coupling bolts	+40
Planer head bolts, without fillet, list	+45
Planer head bolts, with fillet, list plus 10 and	+55
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	+60
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add +85
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails, base	$6 10
Cut nails, base	7 00
Miscellaneous wire nails	50%

ROPE AND PACKINGS

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28

POLISHED DRILL ROD

Discount off list, Montreal and Toronto ..... net

STEEL & IRON PRODUCTS

Quality

Service

OF EVERY DESCRIPTION

HAMILTON PIG IRON

Basic Malleable Foundry

STEEL AND IRON BARS

OPEN HEARTH STEEL SHEETS

RAILROAD TRACK MATERIAL

Angle Bars Track Bolts Tie Plates Tie Rods Spikes

SCREWS

Steel
Brass
Bronze
Wood and
Machine
Screws

WIRE

Steel and Brass, Copper and Bronze, Heavy and Fine, Bright, Annealed, Coppered, Galvanized, Tinned, Stranded, Steel and Copper Cable, Barb, Woven Clothes Line

NAILS

Wire
Cut
Boat
Horseshoe
Shoe Nails
Tacks

POLE LINE HARDWARE

Pole Steps Cross Arm Braces Guy Clamps Guy Rods

WROUGHT PIPE

Black Pipe
Galvanized Pipe
Nipples
Couplings

FORGINGS

Car Axles
Shape and Drop Forgings
Carriage and Automobile Hardware

LEAD PRODUCTS

Lead Pipe
White Lead
Shot
Putty

BLOOMS
BILLETS
PLOW BEAMS
ANGLES
CHANNELS

THE
STEEL COMPANY
OF
CANADA
LIMITED
HAMILTON MONTREAL

WIRE RODS
HORSE SHOES
FENCING
RIVETS
BURRS

If interested tear out this page and place with letters to be answered.

MISCELLANEOUS

Solder, strictly	$ 0 28½
Solder, guaranteed	0 30½
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	20 35
Red dry lead, 100-lb. kegs, per cwt.	15 00
Gasoline, per gal., bulk	0 42
Pure turp., single bbls., gal.	3 15
Linseed oil, raw, single bbls.	2 37
Linseed oil, boiled, single bbls.	2 40
Wood alcohol, per gal.	4 00
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S.S. drills, wire size	35
Can. carbon cutters, plus	10
Standard drills, all sizes	35
3-fluted drills, plus	10
Jobbers' and letter sizes	35
Bit stock	40
Ratchet drills	10
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers, carbon	50
Centre reamers	5
Chucking reamers	net
Hand reamers	10
High speed drills, list net to plus	20
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	70	85
Class B	30	40
Class C	20	30

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 9 25	$ 9 00
Sheets, blue ann., No. 10	7 75	7 50
Canada plates, dull, 52 sheets	13 00	13 00
Can. plates, all bright	14 00	.....
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	13 00	.....
Fleur-de-Lis, 28 B.W.G.	12 50	.....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	11 50
Premier, 10¾-oz.	11 50	11 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	35 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb	.....
Royalite, per gal., bulk	29½
Palacine	32½
Machine oil, per gal.	65
Black oil, per gal.	34
Cylinder oil, Capital	1.01
Petroleum fuel oil, bbls., net	19

BELTING—No 1 OAK TANNED

Extra heavy, single and double	6½
Standard	6½
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 30
Brass sheets, 24 gauge and heavier, base	0 38
Brass tubing, seamless	0 42
Copper tubing, seamless	0 44

WASTE

XXX Extra	.23	Atlas	.19
Peerless	.22	X Empire	.18½
Grand	.21½	Ideal	.18
Superior	.21½	X Press	.17
X L C R	.20		

Colored

Lion	.16	Popular	.12
Standard	.14	Keen	.10
No. 1	.14		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.20
Dark colored	.09
Mixed colored	.10

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$35 00	$37 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	40 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	43 00	46 00
Copper sheet, planished, 16 oz. base	47 00	50 00
Braziers', in sheets, 6 x 4 base	39 00	42 00

LEAD SHEETS

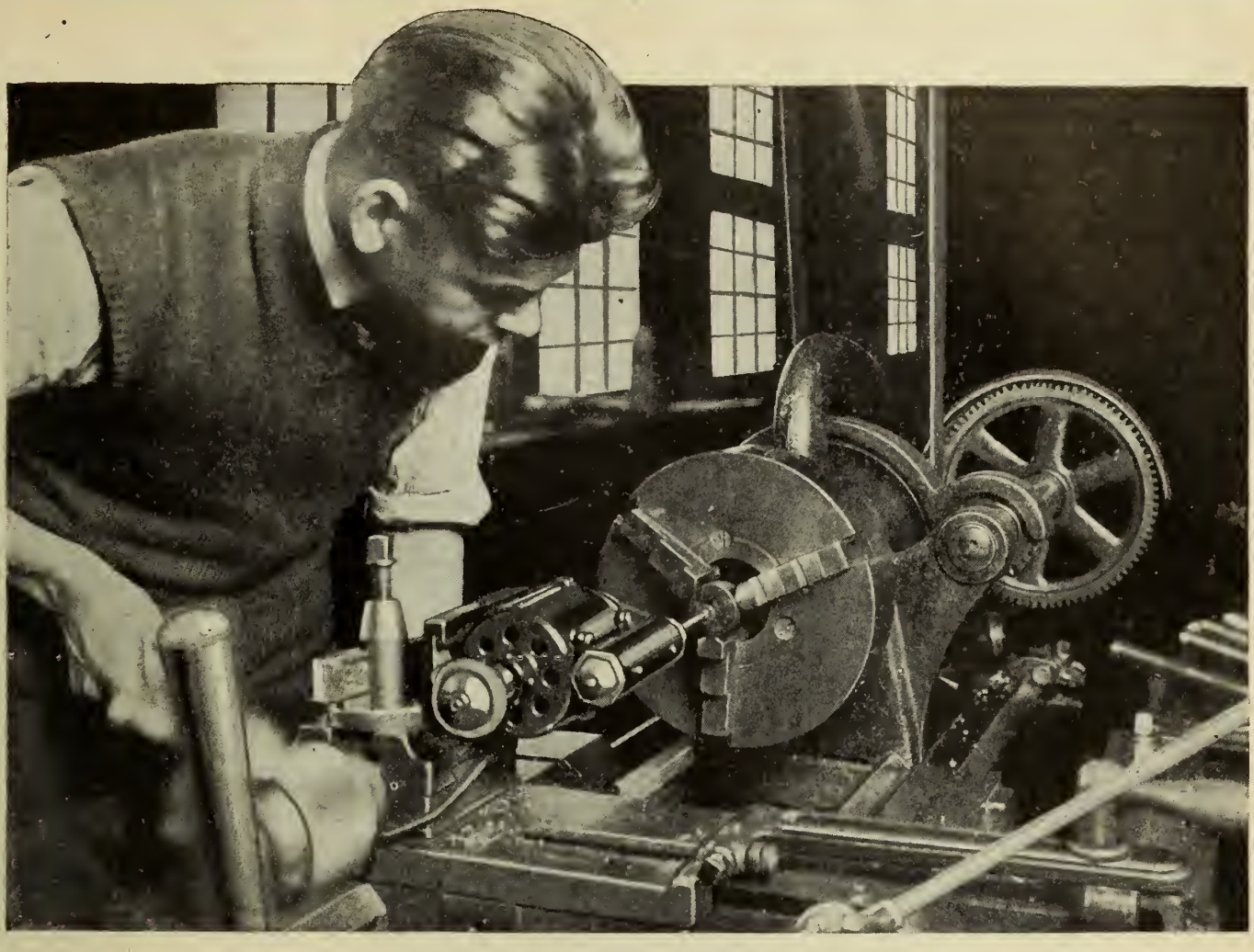
	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 50	$14 50
Sheets, 3½ lbs. sq. ft.	10 25	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 00	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.04¾
Acid, nitric	.11
Acid, sulphuric	.04½
Ammonia, aqua	.15¾
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.16
Copper, carbonate, annhy	.41
Copper, sulphate	.13
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.20
Nickel carbonate	.32
Nickel sulphate	.20
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lbs	9.00
Sodium phosphate	.15
Tin chloride	.30
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated



Grinding Diameters on Ring Gages to Close Limits

In the Terry Turbine Company of Hartford, Conn., Dumore Grinders are used on jobs where accuracy is of the utmost importance.

The job shown here is a special Gage—diameter .750-in. with plus or minus limits of .0002 in. Because the Dumore grinds to extremely close limits it is just the tool for work of this character. Besides, the ease with which it can be set up for service wherever necessary gives it an advantage over other methods of handling many kinds of work.

Dumore Grinders can be used anywhere, taking their power from the nearest lamp socket; extremely simple and durable, they offer an economical method for accurately finishing work without changing the setting.

See the Dumore at work. Ask a man who uses one. Or have your dealer give you a demonstration.

Wisconsin Electric Company

2930 **Sixteenth Street** - **Racine, Wisconsin**

DUMORE HIGH SPEED GRINDERS

If interested tear out this page and place with letters to be answered.

EFFECT OF THE WAR NOTICED ON THE ENGINEERING PRACTICE IN ENGLAND

AN INTERESTING statement on the developments in the machinery and engineering trades resulting from the war has been made exclusively to this journal by the officer in charge of the Toronto office of the Department of Overseas Trade. He states that during the war the need for the introduction into Great Britain of new manufactures, or methods of manufacture, was due to many causes, but chiefly to the isolation of the Central European Empires as sources of supply and to the scarcity of labor and the resultant urgency for labor saving or eliminating devices.

The first cause led to the manufacture of goods formerly produced almost entirely by Germany and her allies, e.g., magnetos, toys, dyes, etc. These are lines in universal demand, but others of which Germany had the monopoly and which, although in somewhat limited demand, were essential to certain British industries, including nail-making machinery, wire (especially barbed) making machinery, chain-making machinery, and machines for embossing celluloid and similar compositions, e.g., for fountain pens, etc.

The second cause was responsible for even greater changes in the engineering world. Factory machinery was altered and adapted for carrying out large numbers of operations for which several machines were formerly necessary. One operator was thereby enabled to do work which formerly necessitated the employment of several. In many cases the development was carried further by making the combined machine automatic, so that one operator was able in some cases to attend to as many as six machines.

Labor-Saving Devices

The lack of unskilled labor for transport made it necessary to devise power to replace it, and the outcome has been the introduction of many kinds of moving tables, conveyors, transporters, trolleys, overhead cranes, etc., which bring the material from the store, convey it in turn after each set of operations to the next machine, and finally carry it to the inspection departments and thence to the trucks, almost without human hand having touched it.

This search after labor-saving devices is seen in intensified and elaborated forms in the offices of amalgamated firms engaged in the same or kindred lines, where it is undertaken with a view to eliminating the possibility of overlapping and duplication of work with its consequent waste of labor, etc., and for the purpose of cutting costs and increasing production.

The scarcity of labor produced a dearth of essential raw materials, especially fuel, and there has consequently been a determined effort to introduce on ships, locomotives and other transport prime movers the use of oil instead of coal, e.g., the "Lusitania," "Aquitania," and "Olympic," as well as the recent locomotive trials on the L. and N. W. Railway. In addition to ensuring the supplies of fuel, this innovation dispenses with the need for at least half the manual labor formerly employed. Other directions in which this tendency is noticeable are seen in the increased use of automatic couplings, electric signalling, still engines, and electric trolleys on station platforms.

In agriculture the tendency is even more marked and tractors are being universally employed to do work for which it was formerly necessary to employ dozens of men and horses. Two men with a tractor and a seven-furrowed plough can turn out a very large acreage in a few weeks. The same tractor and staff can then be turned to harrowing, grubbing, rolling, sowing, hoeing, reaping and binding, and the entire season's agricultural work of this nature on a farm of 1,000 acres could probably be done by four men or women.

The introduction and development of the caterpillar tractor has made it possible to cultivate marshy, hilly and other difficult soils formerly inaccessible and consequently useless. In this line the home manufacturers are keeping well to the front, although severe competition has been experienced from American firms. In overseas markets the British tractor has a hard-earned reputation for "standing-up" to its work, which it will take more than the usual type of foreign-made tractor to surpass. This was clearly evidenced at the recent trials at Lincoln, when English firms again showed their superiority of workmanship, many awards being carried off. The ever-increasing price of labor, the shorter hours worked, the reduced productivity of the workers, and the consequent scarcity of raw material is making their fight a hard one. Many, however, have achieved notable successes and are confident of capturing and holding a very large share of the world's markets.

COLLINGWOOD CO. GETS THE CONTRACT

And Work at Dominion Shipbuilding Plant Will Be Carried On In a Few Days

The plant of the Dominion Shipbuilding Company at Toronto, which has been idle since the company went into liquidation some time ago, is to be operated again for at least five or six months. The liquidator, Mr. Osler Wade, announced that at a conference with the Minister of Marine and Fisheries, Hon. Mr. Ballantyne, arrangements had been completed for the finishing of work upon the two Dominion Government ships in the yards. The work will be taken over by the Collingwood Shipbuilding Company, which will employ about a thousand men. Places will be found for a large percentage of the old staff and wherever possible preference will be given to returned men. The two vessels are of 4,000 tons each and it is estimated that they will provide employment for a large number of men on into the spring or early summer.

Mr. Wade stated that he would make no attempt to sell the plant at present and that any offer made for it, during the completion of the two ships, would be subject to the arrangement made with the Minister.

FIRMS WANT TO ESTABLISH TRADE RELATIONS WITH CANADA

Information regarding the following lines can be obtained by communicating with this paper and mentioning key numbers.

2524. Insulated Wire and Cables.—A firm of merchants and commission agents in Constantinople desires particulars from Canadian exporters of insulated wire and cables of all dimensions.

2516. Rails.—A British firm in Constantinople with extensive connections desires to receive particulars from Canadian suppliers of rails, with a view to future developments of this trade.

2517. Agricultural Machinery.—A large British firm in Constantinople with extensive connections are desirous of receiving particulars from Canadian suppliers of agricultural machinery of all kinds with a view to the resumption of normal trade with that centre.

2518. Metals.—A firm of merchants and commission agents in Constantinople desires to receive particulars from Canadian exporters of metals in general.

2519. Mining Machinery.—A British firm in Constantinople desires to get into touch with Canadian exporters of mining machinery.

2509. Nails, Bolts and Nuts.—An Edinburgh firm wants to order self-colored or galvanized drive roofing, screw nails, and bolts and nuts, as per sample at Department of Trade and Commerce, Commercial Intelligence Branch, Ottawa.

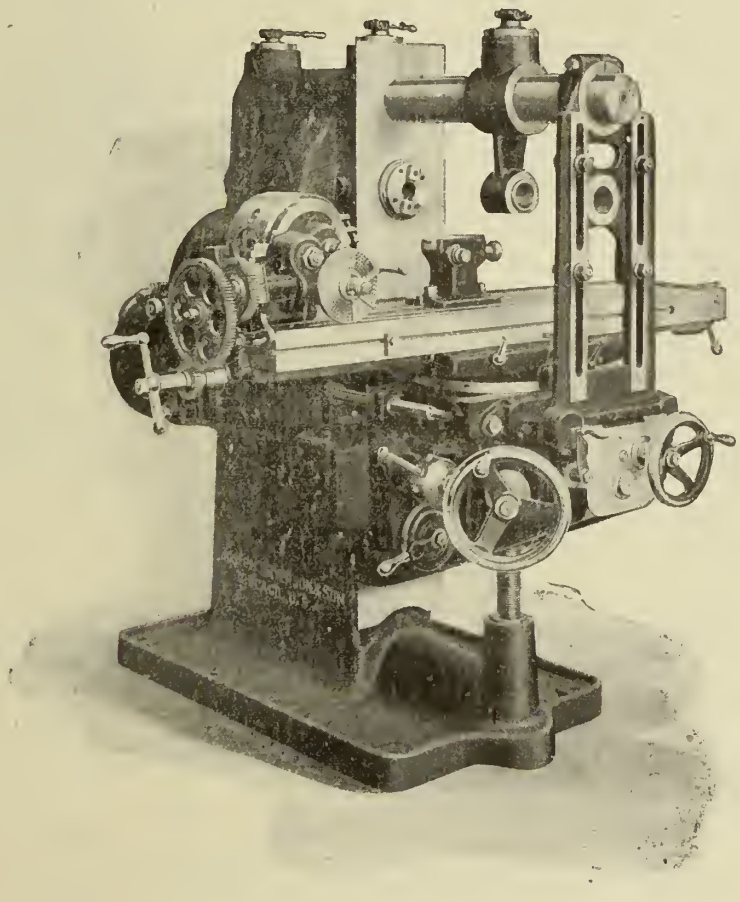
2512. Small Tools, Machine Tools, Grinding Wheels, Vises, etc.—A Sydney agent desires to hear from Canadian manufacturers regarding the above tools.

2502. Graphite.—A Nottingham firm would like to receive prices and samples of any Canadian graphite.

During November building permits issued for the city of Toronto total in value $1,482,914 and the total permits issued so far during this year are $24,333,626, showing large increases over the amount of $17,779,811 for the corresponding period of 1919.

Ryerson-Conradson No. 2 Milling Machines

In Stock for Immediate Shipment



The Ryerson-Conradson Milling Machines embody a number of patented features in design, which make them particularly suitable for modern shops where speed, accuracy and strength are required.

A few of the most prominent features of these machines are: The herringbone gear drive to spindle, Splash oiling system, Large feed and speed range, and the method of containing all driving mechanism in the column.

Before purchasing your next Milling Machine investigate the Ryerson-Conradson Line. Write for complete descriptive bulletins.

JOSEPH T. RYERSON & SON

CHICAGO, ILL., U.S.A.

Canadian Representatives: **MACHINERY**

GARLOCK-WALKER MACHINERY CO., 32-34 Front Street West, TORONTO

MONTREAL **WINNIPEG**

If interested tear out this page and place with letters to be answered.



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES



BIG INDUSTRIAL PLANTS ARE GOING TO RUSH WORK IN LONDON

Special to CANADIAN MACHINERY.

LONDON, Ont.—Industrial developments which will materially increase this city's machinery output have been completed by the Chamber of Commerce and Board of Trade and plans are being prepared for new factory buildings to cost well over $2,000,000. Work is already in progress on a $250,000 plant for the Ruggles Motor Truck Company, of Alma, Michigan. Negotiations were completed last week for the purchase in Chelsea Green of fifty acres on which the Canadian plant of the Service Motor Truck Co., of Wabash, Indiana, will be erected. Plans are being rushed and material purchased and construction will commence as early as possible in the spring. In order to supply the malleable castings required for the Ruggles Co. and the Service Co., a third plant is to be erected to cost $200,000. This will be owned jointly by the two firms and local capital. One of the largest foundries in the district will be established in connection with the project.

As a result of this Beattie Bros., of Fergus, in order to secure castings and parts with greater facility, are preparing plans for a $250,000 extension to their plant. Work has already commenced on laying new sidings into the site in Chelsea Green and work on the buildings, which will be of reinforced concrete construction, will commence early next year. The main building will be a large and thoroughly modern machine shop, and a power house will also be erected.

The London Concrete Machinery Co. has been getting some heavy export orders lately and in order to take care of the business is erecting a $50,000 addition to its factory. Negotiations are under way for securing the rights for manufacturing a gasoline engine and the firm plans the erection of a $100,000 plant which will be used exclusively for this work.

The Stansell Motors, Ltd., of Amherstburg, has purchased a site of 35 acres in East London, and is preparing plans for a large new plant. London has every hope of becoming one of the most important motor centers in the Dominion, and along with the firms already secured it is expected negotiations will be closed shortly for several subsidiary factories manufacturing specialties required.

Another big plant to be erected is that for the Rawleigh Products Co., of Freeport, Illinois. A site has been purchased adjoining the C.P.R. tracks on Adelaide Street and plans are being prepared for a five-storey reinforced concrete building 300 by 180. The firm manufactures various chemical products.

In the district a couple of fairly important industrial projects are under way. At Strathroy the ratepayers are to vote on a $35,000 by-law which if carried will mean important extensions to the plant of the Andrews Wire Co., which also has a factory at Watford.

At Goderich a by-law will be submitted in connection with the building of a $100,000 plant for the Goderich Manufacturing Co. This was formerly the Baechler Company, whose big factory was completely destroyed by fire. It manufactures various wood products. Goderich ratepayers will also vote on a proposition for the establishment in the town of the plant of the Huron Specialties Castings Co., of Clinton. It is proposed to erect a foundry and greatly enlarge the present capacity of the business.

As a result of the Thomas A. Edison Co. purchasing the entire plant at St. Thomas, Ont., in which the firm of Lawson & Jones, of London, had their box factory located, and the Starr Phonograph Co. manufactured cabinets, these two are seeking new quarters. Toronto will likely secure the Lawson & Jones box making plant, and the Starr people expect to locate in London as their head office is here.

Building New Plant

The Canadian Tygrad Engine Co., Toronto, has awarded contract for its carburetor plant to be erected on Kingston Road at a cost of $40,000, to the Trussed Concrete Steel Co., 34 King Street West, Toronto.

Big Contract

The Three Rivers Pulp & Paper Co., Ltd., have awarded the general contract to William I. Bishop, Ltd., Montreal, for the construction of its plant at Three Rivers, Que., to cost with equipment $1,500,000.

Trade Gossip

Moving Head Office.—The Standard Steel Construction Co., with plant at Port Robinson, have transferred their head office to Welland. The company during the war operated a munitions plant at Port Robinson and have been gradually disposing of machinery that is not required in their regular line of manufacture.

Had a Good Year.—A record year's earnings is disclosed in the annual statement of Canada Iron Foundries, Ltd., now being sent to shareholders in advance of the annual meeting to be held on January 24 next. Foundry earnings for the twelve months ended September 30, 1920, before depreciation and other

PERSONAL

Ethan Viall, for ten years a member of the staff of the American Machinist, has resigned as editor-in-chief to become a member of the firm of T. W. Minton & Co., Barbourville, Kentucky, U.S.A., the largest producers of hickory dimension stock in the country. Previous to joining the staff of the American Machinist Mr. Viall was associate editor of Machinery, and before that he was for fourteen years foreman and superintendent in several of the largest specialty manufacturing plants in the Middle West. He was at that time also a frequent contributor to Canadian Machinery and other technical journals. He is a member of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the Society of Automotive Engineers, the American Welding Society, the American Society for Testing Materials, and the Franklin Institute. He is author of Broaches and Broaching, Gas Torch and Thermit Welding, Electric Welding, United States Artillery Ammunition, United States Rifles and Machine Guns, and the Manufacture of Artillery Ammunition. The last named book was compiled by the staff of the American Machinist largely from material gathered in Canada during the early days of the World War, and did much to assist shop men in fitting up for munition work. Mr. Viall is especially well known to the machine tool men around Cincinnati, Cleveland, Detroit and throughout the Middle West, where he travelled for six years in the interest of his paper.



"MORROW Drills have Cut the Cost of Production"

MANAGER OF MANUFACTURING PLANT: "According to your figures here our drilling results show a vast improvement. Our operators are turning out more work and our drilling expense is less than formerly."

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MANAGER: "Then it will pay us to use Morrow Drills exclusively."



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DRINKING CUPS ARE UNSANITARY but the "Puro" delivers clean, fresh water at a reduction of 15 per cent. to 35 per cent. in water bill.

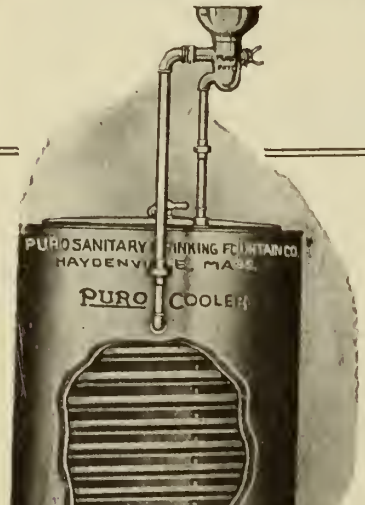
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WHEN WRITING TO ADVERTISERS KINDLY MENTION THIS PAPER

charges, amounted to $603,562, an increase of $114,619 over the preceding period, and $580,824 in 1918.

Let Contracts.—Premier Foster of New Brunswick announced that contracts for machinery for the hydro-electric installation at the Musquash River had been awarded on the recommendation of the water powers commission. The contractors and the contract prices are as follows: S. Morgan Smith, $93,056, hydraulic machinery; Canadian General Company, $162,000, electrical machinery.

Boiler Exploded.—One man was killed and eight others injured when a small boiler used for heating water in connection with operations on the new cooperage factory at Fort Coulonge, Quebec, exploded, wrecking the boiler room of the building and sending flying debris and scalding water into a crowd of workmen. The factory belongs to the Sutherland-Innes Company, Limited, of Sunbridge, Ontario. Two of the injured were taken to Ottawa.

Reopening Part of Plant.—The following official statement was issued from the general offices of the Dominion Iron and Steel Company, which is heating up seven of its open-hearth furnaces. These are to be placed in operation at once, for the purpose of producing the steel required to permit the carrying out of some contracts against which delivery must be made during the next two weeks. "The re-opening of partial operations in the steel department will give employment to some of the men whose services it has not been possible to utilize since the interruption two weeks ago." Dominion has received a rail order from the Government.

Build Steel Bridge. — Reeve Harry Smith submitted the preliminary report of Engineer McGeorge on the proposed new bridge at Prairie Siding at the Kent county council at Chatham and gave notice of motion to have final plans prepared and work proceeded with at once. The plans call for a steel structure of two spans, a fixed span of 200 feet and a swing span of 180 feet, to be constructed just west of the present ferry. The estimated cost is $150,000. Engineer McGeorge advised the council to take steps to widen the channel in the river at Prairie Siding and Bagnall's Bend, which, he said, would remove two great trouble makers at the time of ice jams.

Conditions at Scotia.—D. H. McDougall, president of Nova Scotia Steel & Coal, is reported as stating, relative to conditions in the East:

"The general position of the Scotia Company is improving from day to day. That change will become much more evident in the next twelve months than now. Substantial improvements in our position are being made from time to time, and before long we will begin to show this. Developments in the ore fields and the various coalfields will but serve to justify and strengthen our claims as to the value of the property. We expect to make extensive shipments of ore to Europe from our own iron mine during the coming year."

A New Project.—The Dominion Foundries & Steel, Limited, Hamilton, are making a private offering of $800,000 7 per cent. cumulative preferred in the Adirondack Steel Foundries Corporation at par of $100, along with a bonus of three shares of no par value common, of which latter there are 40,000 shares in existence. The company has no bond issue. Shareholders had the privilege of subscribing for any amount they desire up to Dec. 11, when allotments were made pro rata with share holdings on the date mentioned, any unsold balance thereafter being offered for public subscription. The property of the Adirondack Steel Foundries Corporation consists of 29 acres of land and a large modern steel casting plant under construction and in partial operation. The location at Watervliet, N.Y., on the belt line between Albany and Troy, is said to be advantageous for purchasing raw material. There is also reported to be an excellent market for the finished product, as the plant is situated to cater to the steel casting demands incident to a population of 20,000,000 people.

To Build Foundry

New tenders will be called in the spring for an addition to the foundry of the Corbet Foundry & Machine Co., 1064 First Avenue West, Owen Sound, Ont., to cost $25,000. W. Forrester & Clark, 1076 First Avenue West, are architects.

WILL ASSEMBLE MOTOR CARS SOON

New Departures To Be Undertaken By The Armstrong-Whitworth of Canada

As soon as plans can be completed the Armstrong-Whitworth Co., of Canada, intend to go in for the production of wood pulp plant equipment, and water turbines at the Longueuil works, where the assembling of motor cars, the Armstrong-Siddeley, will also be undertaken.

Mr. Wheatley is retiring from the presidency of the company at the end of the present year. Captain Grant is acting as general manager until such time as the reorganization of the company has been completed.

Several other changes have taken place in the personnel of the shop executive recently. Mr. MacFayden is superintendent of the Longueuil plant; Mr. Brigg is now cashier and accountant in place of Mr. Price, who resigned some weeks ago. The purchasing for this company is now done through the Montreal office, at 298 James St.

Mr. Russel is on a trip to the west and California. On his return he is coming via British Columbia, where the firm is interested in a hydro-electric installation.

Engineering

A Filtration plant costing $50,000 is being planned by the town of Smith's Falls.

The Oakoal Co. Canada, Limited, 43 Scott St., Toronto, plans to build a plant at Montreal in the spring.

G. Dupont, Montreal, has awarded contracts for the erection of a brass foundry and workshops on Aird Avenue.

A permit has been issued for the erection of the new Paramount Theatre at Peterborough, Ont., at a cost of $115,000.

The Progress Spring Bed Co., Ltd., 148 Cadieux Street, Montreal, has awarded contracts for an addition to its factory to cost $10,000.

A new store is being planned by the L. R. Steel Co., at the corner of Jasper Avenue and 101 Street, Edmonton. The estimated cost is $350,000.

It is expected that the Board of Education, Toronto, will spend about $2,000,000 next year on the purchase of sites and erection of school buildings.

A group of outside capitalists are taking into consideration the building of a two million dollar hotel on the north side of Eighth Avenue, between Third and Fourth Streets, Calgary.

The Canadian Libby-Owens Sheet Glass Co., a five million dollar concern, is starting the immediate erection of a large plant in Hamilton, Ont. Ralph King, of the Dominion Glass Co., Montreal, is president.

The building formerly occupied by the Regina Trading Co., and owned by Gustave Michaelis, has been purchased by Ryan Motors, Limited, Regina, and it will be altered into a garage and show rooms at a cost of $40,000.

The McDougall corner, Edmonton, Alta., has been purchased by the L. R. Steel Service Corp., Ltd., Royal Bank Bldg., Toronto, and the erection of modern fireproof stores and office building at a cost of $350,000 is contemplated.

Modern fireproof buildings will be built to replace those destroyed by fire at the Muskoka Free Hospital at Gravenhurst. The cost of the buildings will be $175,000 and with the necessary equipment the total expenditure will be $250,000.

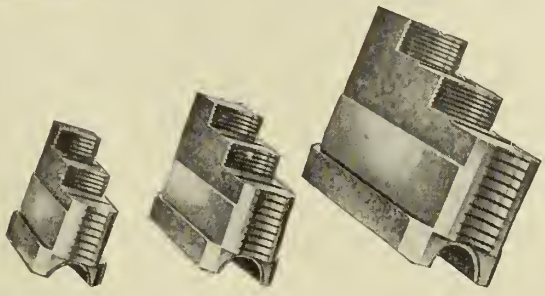
T. W. Lamb, architect, 269 Victoria St., Toronto, Ont., is preparing plans for a theatre at Saskatoon, Sask., to cost $200,000 for the Famous Players Canadian Corp., Toronto. The theatre will have seating capacity of 1,500.

The plans have been perfected by the Fraser River Timber Syndicate for the establishment of a large pulp and paper mill at Prince George, B. C., involving an investment of over $6,000,000. Application has been made for three separate water powers, any or all of which may be developed.



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AMERICAN MANUFACTURER OF SANITARY drinking fountains who has made arrangements to have his line manufactured in Canada wishes to get in touch with a man who can sell the appliance in industrial plants of all kinds. Box 730A, Canadian Machinery.

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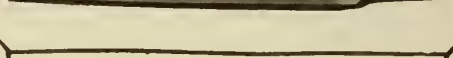
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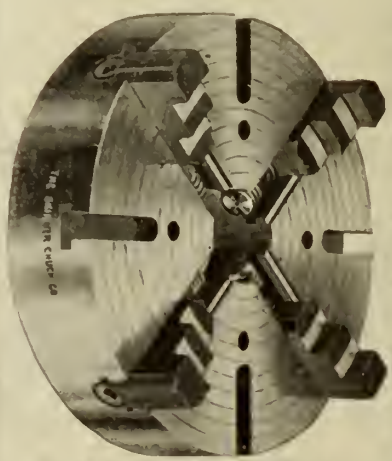
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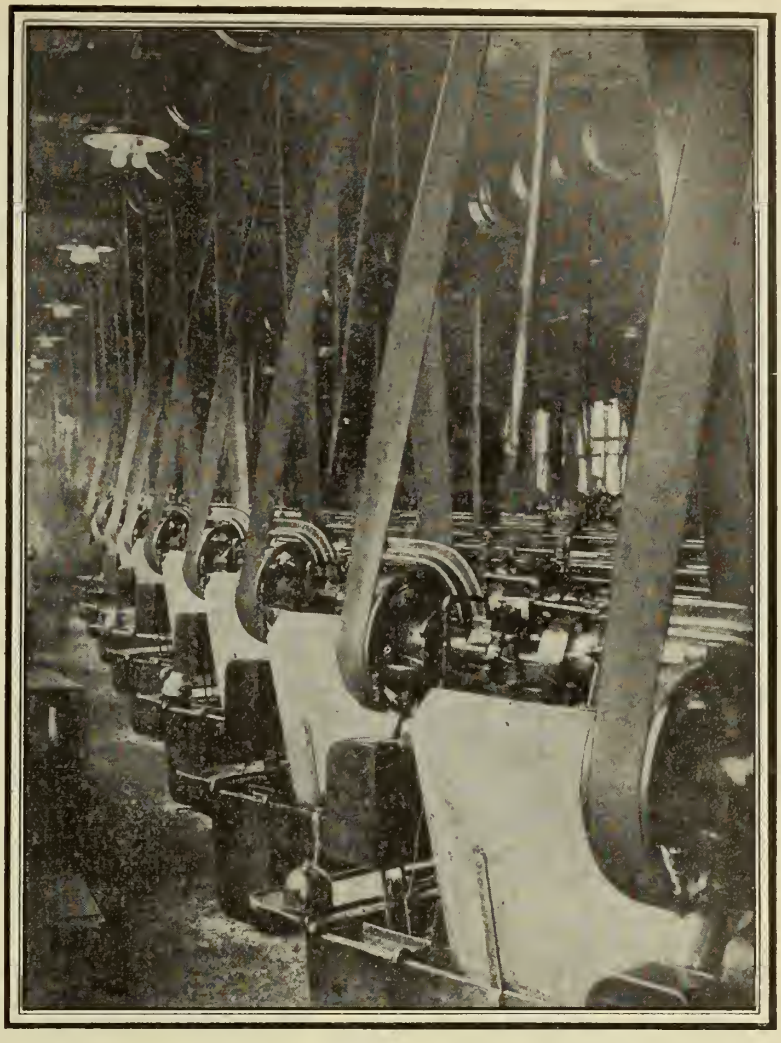
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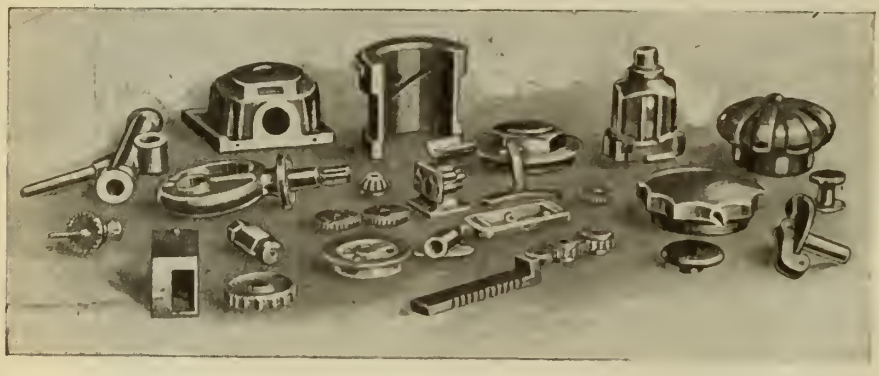
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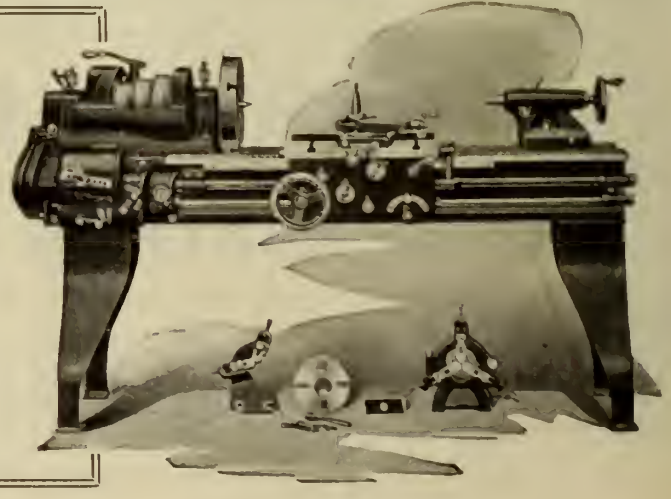
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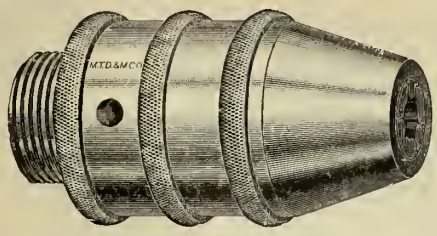
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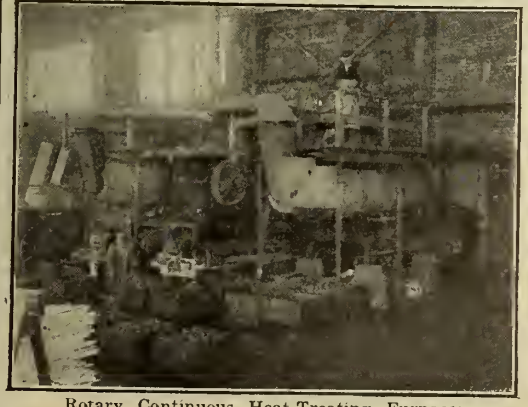
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What Will Santa Claus Bring Our Politicians ?

"SANTA'S POLITICAL STOCKING" is the title of J. K. Munro's feature article in MACLEAN'S December 15th issue. Mr. Munro thinks old Kris Kringle should bring Premier Meighen a "cap that will pull down over his ears, so that he can't hear what his Cabinet colleagues are saying about him"; a hobby horse for Crerar; a tin sword for Ballantyne; a "white plume" for Lapointe; a case of grape juice for Rowell, and a pair of long trousers for Mackenzie King.

Mr. Munro also sizes up the East Elgin farmers' victory, and lets you know its real significance.

Dr. Wilfred T. Grenfell, C.M.G.

THE famous physician of Labrador has contributed a striking piece of graphic fact-fiction for the Christmas issue—"Deeds of 'Derring Do'," which describes the brave fight waged by Skipper Loveday, his crew and wife—in the dismantled Silver Queen. They expected to find a watery grave that Christmas week, but the wife's dauntless spirit put so much courage into the men that they won a fearful fight against the December gales.

Christmas Issue of Maclean's, December 15th

"THE EMANCIPATION OF POLLY MacCRAE"
By F. B. M. Collier.
The so-human story of two spinster sisters in Old Ontario and how the crippled one won a husband.

"THE JEST OF CIRCUMSTANCE"
By Gertrude Arnold.
Phyllis lands in a Canadian city, fresh from England, and there is no fiancé to meet her. The girl ultimately finds happiness just as the Christmas Carols commence—but how?

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"THE CITY OF PERIL"
By Arthur Stringer.
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"—AND ALL POINTS NORTH."
By Nellie L. McClung.
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"OF CHRISTMASES AND GOVERNORS"
By Colonel George Ham.
The "Colonel" has spent Christmas in some peculiar places. His experiences form the foundation of a great story. Also, Col. Ham tells of the human side of some of our Governors-General.

"WHO GETS OUR PAPER PROFITS?"
By Agnes C. Laut.
The real facts of our paper, pulp and sulphite products, and some information as to where the biggest slices of the melon go.

"THE YULETIDE GLOW"
By Charles Christopher Jenkins.
What converts Scrooges into human beings, 'round about December each year? Get in a crowd with "Jenk" and you'll find out.

"BUTTERED SIDE UP"
By C. W. Stephens.
The hero of this story loses his job a few days before Christmas. But he doesn't lose the girl, and lands a real job Christmas Eve.

"ORATORS I HAVE ENJOYED"
By "Margot" Asquith.
The wife of the ex-Premier tells what she thinks of Lloyd-George, as an orator, and others.

Review of Reviews Section

"The War Spirit in the World"—By Sisley Huddleston.
"The Irresistible Thing"—By Sir Gilbert Parker.
"German Universities Hard Up"—By Allen W. Porterfield.
"The Bleeding Statues of Tipperary"—By Edwin E. Slosson.
"A Modern Burton"—By Charles A. Merrill.
"Lansdowne's Memories"—By Marquis of Lansdowne, K.G.
"Flesh and Blood Inspired Barrie"—By William de Wagstaffe.
"Doctors Dupes of Fashion?"—London Lancet.

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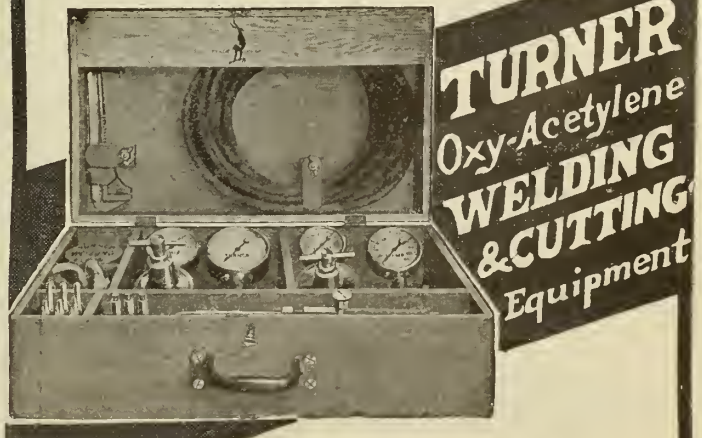
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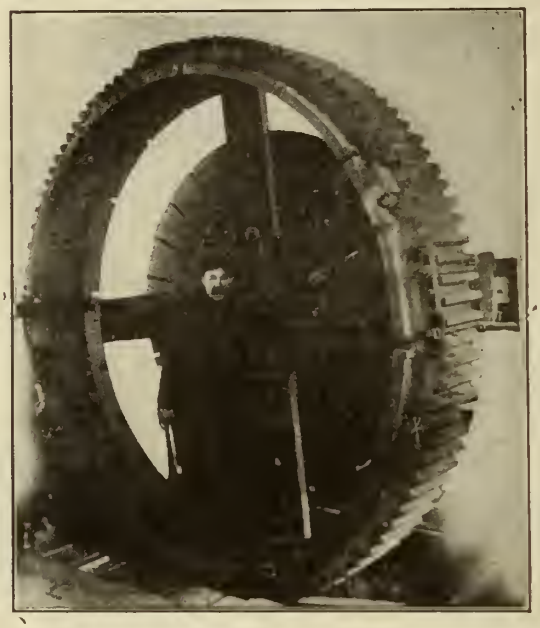
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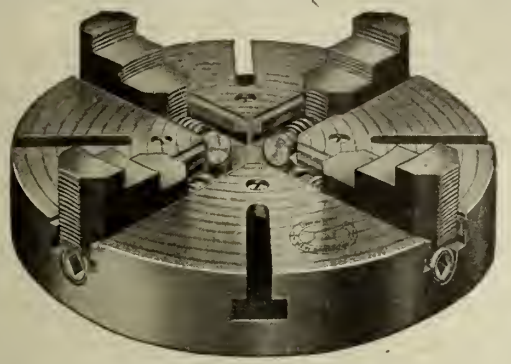
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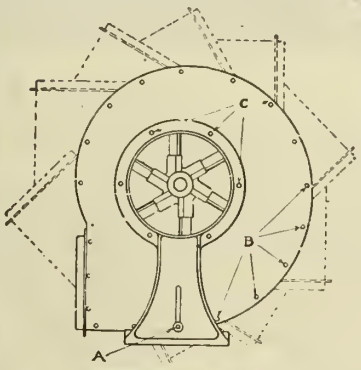
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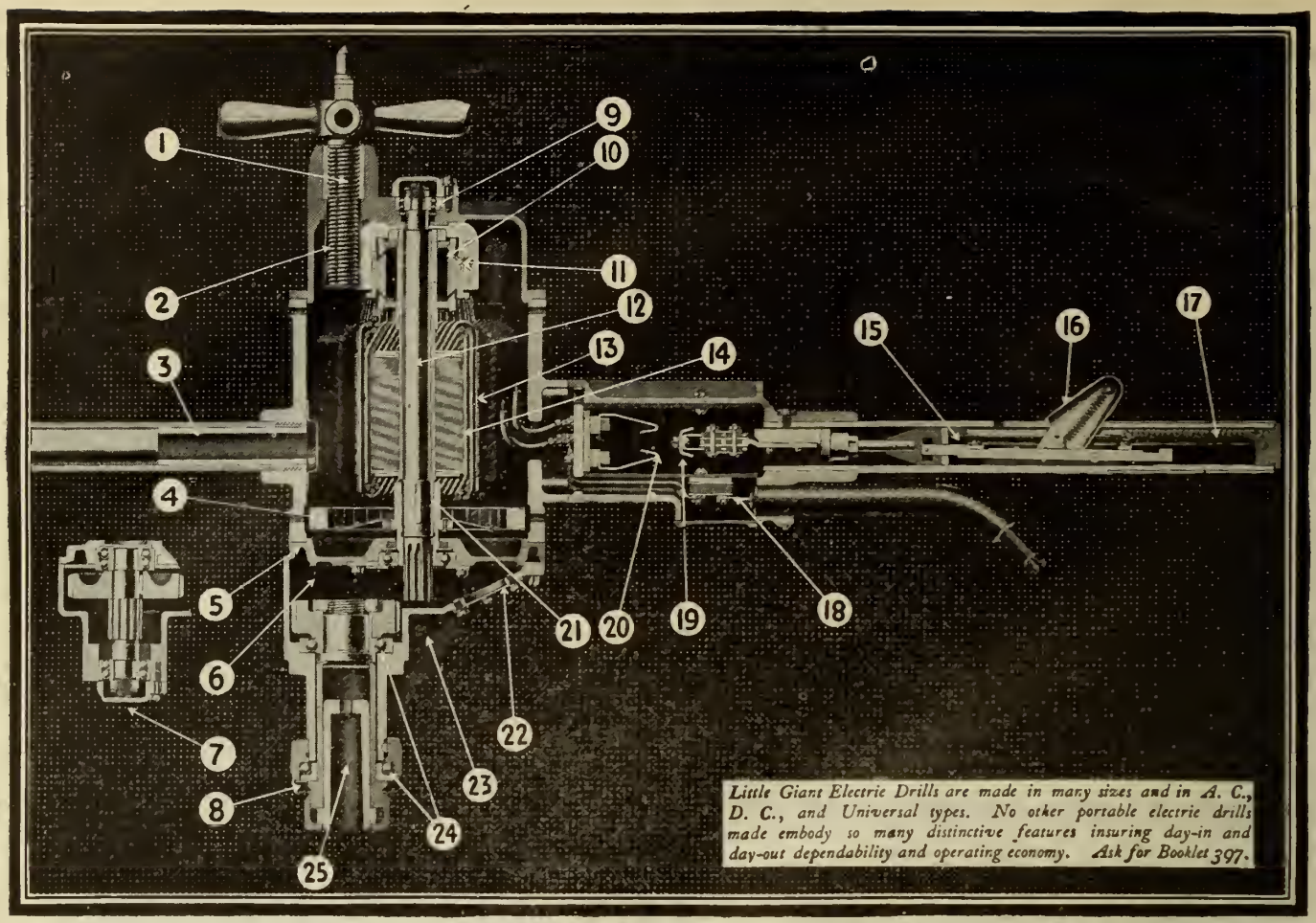
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3 Dead handle reinforced at point of greatest strain.

4 Sheet steel fan, carefully balanced and reinforced, providing thorough ventilation.

5 Solid transfer plate or diaphragm preventing grease or oil in gear case from entering windings.

6 Liberal grease compartment for providing reliable lubrication of gears and ball bearings.

7 Section thru intermediate gears. Note wide *double* row of ball bearings at each end of gear shaft (used on large drills). Pinion and gears made of special alloy steel carefully heat-treated.

8 Dust protector for excluding dust from lower thrust ball bearing.

9 Ball bearing easily accessible for lubrication and inspection.

10 Commutator of sturdy design and construction, thoroughly insulated with mica.

11 Large opening with well secured and readily removable cover plates providing easy access to brushes and commutator.

12 One-piece armature shaft and pinion of tool steel, hardened and ground, insuring perfect alignment of pinion at all times. On large size drills armature shaft is removable from the armature core and commutator, which are mounted jointly on a quill or spider.

13 Laminated pole pieces, minimizing pole face losses (used on large drills).

14 Armature coils form wound, heavily insulated, and carried in insulated slots in armature core. After winding and connecting to commutator, coils and armature are again dipped in insulating varnish and baked.

15 Quick acting control switch, making slow break impossible and preventing destructive burning of contacts.

16 Conveniently located trigger for operating switch.

17 Safety return spring for automatically opening switch when operator removes hand from switch handle (used on large drills).

18 Terminal block for cable, permitting ready removal of cable without disturbing other connections.

19 Cover plates on each side of switch, providing easy access to switch contacts.

20 Double pole, double break switch. Rugged contacts are readily removable.

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22 Cover plate quickly removable for inserting grease in gear case.

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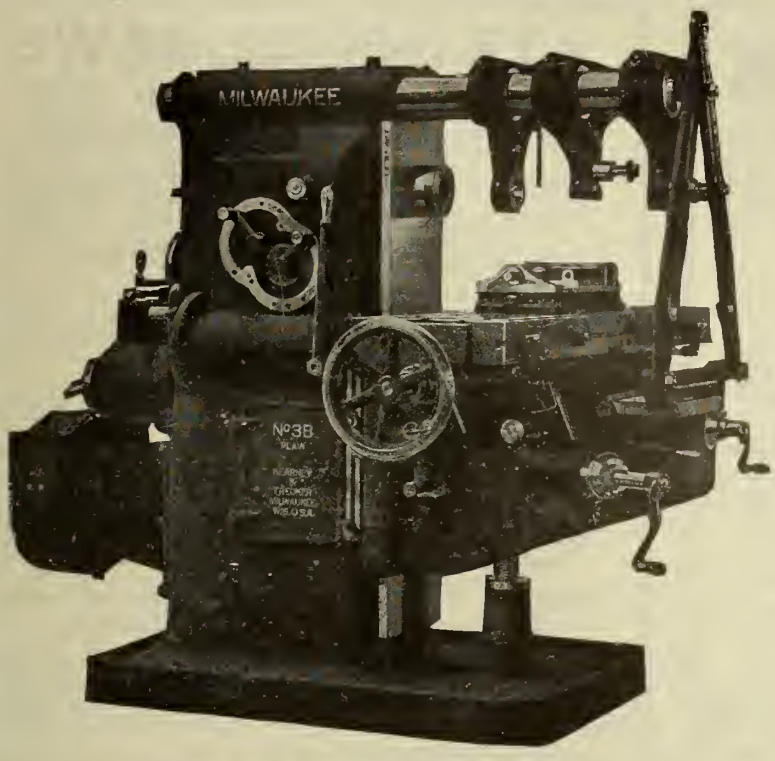
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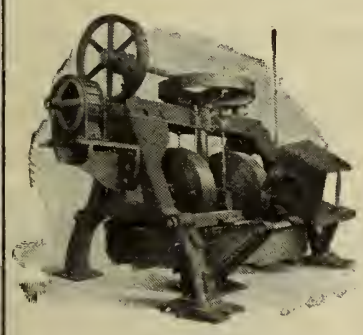

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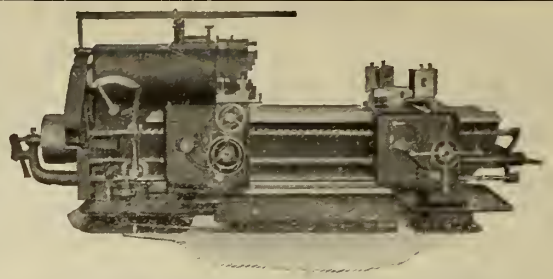
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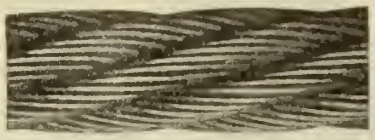
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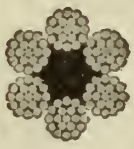
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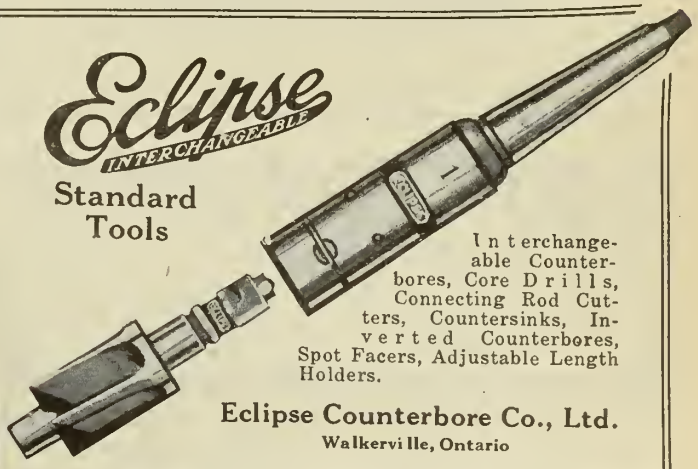
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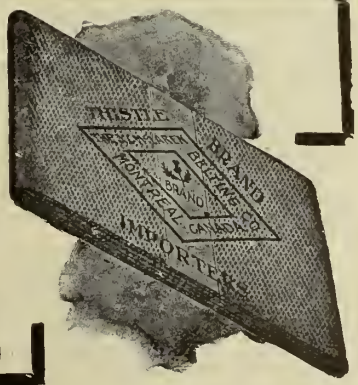
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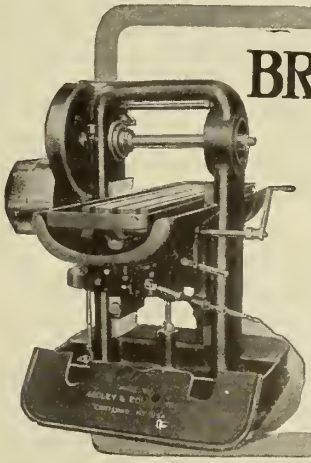
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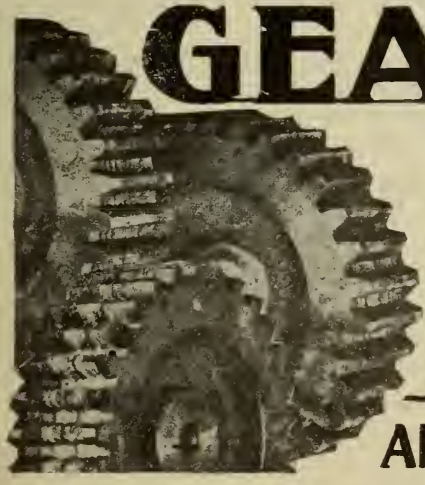
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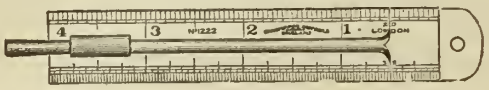
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BUSHING, BRONZE
Morrow Screw & Nut Co., John, Ingersoll

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CABLES, TRANSMISSION AND TELEPHONES
Northern Electric Co., Ltd., Montreal.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Carter Welding Co., Ltd., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Union Carbide Co., of Canada, Limited, Weland, Ont.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville.
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co., Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glasco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

CAR MOVERS
Holden Co., Ltd., Montreal, Que.

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie
Dominion Steel Products Company, Ltd., Brantford, Ont.
Franklin Mfg. Co., Syracuse, N.Y.
Can. Metal Co., Toronto, Ont.

CASTINGS, DIE CAST
Can. Metal Co., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.
Fisher Motor Co., Ltd., Orilla, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

CASTINGS, STEEL—ALL KINDS
Canada Electric Castings, Ltd., Orilla, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co., Ltd., Orilla, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.

CARRIERS COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll.
Alexander Fleck Ltd., Ottawa.
Tallman Brass & Metal Co., Hamilton

CASTINGS, BENCH LEG
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie
Dominion Steel Products Company, Ltd., Brantford, Ont.
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt, Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown, Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co., Ltd., Orilla, Ont.
Dominion Steel Products Company, Ltd., Brantford, Ont.
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
Interantional Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.
McFarlane Engineering Ltd., G. W., Paris, Ont.
Union Manufac'g Co., New Britain, Conn.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd., Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Morrow Screw & Nut Co., J., Ingersoll.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machinery Co., Toronto.
Lyman Tube & Supply Co., Montreal, Q.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.
Renold of Canada, Ltd., Montreal.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Renold of Canada, Ltd., Montreal.
Williams Mchy. Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Can. Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N. Y.
Glasgow, N.S.
Renold of Canada, Ltd., Montreal.

CHAINS, SPROCKET WHEEL
Can. Link Belt Co., Ltd., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Ltd., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Labatory, Ltd., Toronto.

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.
Union Manufac'g Co., New Britain, Conn

CHUCKS, COLLET, AIR
Petrie, Ltd., H. W., Toronto.
Williams Mchy. Co., A. R., Toronto.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford
Foss Mchy. & Sply Co., Montreal.
Gardner, Robt. & Son, Montreal.
Garlock-Walker Machinery Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Herbert, Ltd., Alfred, Toronto, Ont.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Union Manufac'g Co., New Britain, Conn.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Strelinger, Chas. A. Co., Windsor, Ont.
Union Manufac'g Co., New Britain, Conn

CHUCKS, FRICTION AND TAP
Union Manufac'g Co., New Britain, Conn
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Union Manufac'g Co., New Britain, Conn.
Williams Mchy Co., Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Warner & Swasey Co., Cleveland, O.
Williams Mchy. Co., A. R., Toronto, Ont.

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAY FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

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Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York, N.Y.

CLOCK SPRINGS
The Dunbar Brothers Co., Bristol, Conn

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.

CLOSETS
Crane, Ltd., Montreal, Que

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Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

COAL CRUSHERS
Can. Link-Belt Co., Ltd., Toronto, Ont.

COAL HANDLING MACHINERY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Nova Scotia Steel & Coal Co., New

COLD ROLLED STRIP, ALL METAL COLLARS, SHAFTING
Can. Driver-Harris Co., Ltd., Walkerville.
Williams & Co., J. H., Brooklyn, N.Y.

COLLECTORS, PNEUMATIC
Can. Blower & Forge Co., Kitchener
Sturtevant Co., B. F., Galt, Ont.

COMPOSITION INGOT
Canada Metal Co., Toronto.

COMPOUNDS, CUTTING AND GRINDING, DRAWING STAMPING
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR
Atkins & Co., E. C., Hamilton, Ont.
Can. Ingersoll-Rand Co., Sherbrooke.
Cleveland Pneumatic Tool Co., Toronto
Curtis Pneumatic Machy. Co., St. Louis
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Superior Machinery Co., London, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CONDENSERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
MacGovern & Co., Montreal, Que.

CONDUITS
Northern Electric Co., Ltd., Montreal, Que.

CONNECTING RODS
Canada Found'g & Forgings, Ltd., Welland, Ont.

CONNECTING ROD CUTTERS INTERCHANGEABLE
Eclipse Counter bore Co., Ltd., Walkerville, Ont.

CONTRACT WORK
Brown Engineering Corp., Toronto.
Ford-Smith Machine Co., Hamilton, Ont
Globe Engineering Co., Hamilton, Ont.
Katie Foundry, Ltd., Galt, Ont.
Victoria Foundry Co., Ottawa.

CONTROLLERS, MAGNETIC BRAKES, ELECTRIC WINCHES, MONO RAIL HOISTS
Volta Mfg. Co., Welland, Ont.

CONTROLLERS AND STARTERS
Williams Mach'y. Co., A. R., Toronto.

THE GARVIN PAGE

Published by

THE GARVIN MACHINE CO.

Builders of Machine Tools since 1865

Some Speed—we'd say

Garvin Tapping Machines have a pretty fair spindle speed—so much so that they work about as fast as most tapping experts could ask.

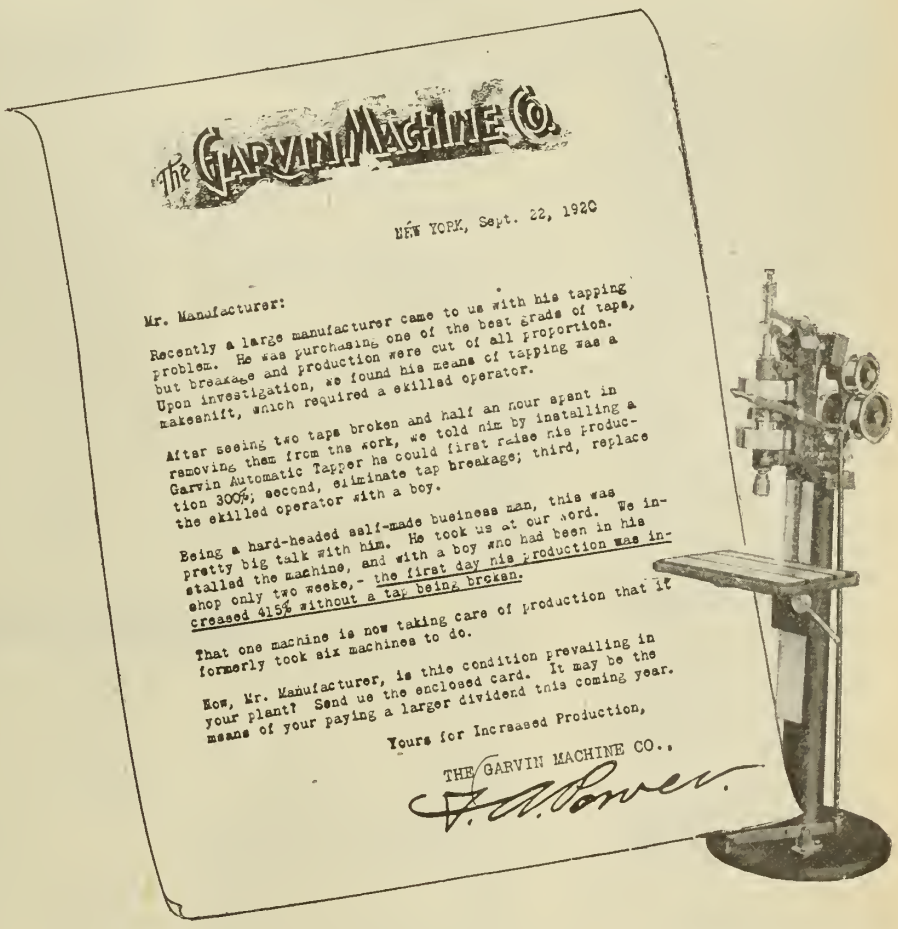
But out in Wisconsin one of the big automobile plants is doing some astonishing work. They've beaten all the records we know of for production on Garvin Tappers. Here's what they say:

"It may be of some interest to you to know that we are running all your tapping machines at about 700 R.P.M. They are standing up remarkably."

That is just double the speed for which they are ordinarily arranged. We wouldn't recommend that anybody speed up machines to this extent but, like some of the automobile speed contests, it goes to show what "stock machine" can do.

H. R. GARVIN

An Open Letter on Tapping



The Garvin Machine Co.

NEW YORK, Sept. 22, 1920

Mr. Manufacturer:

Recently a large manufacturer came to us with his tapping problem. He was purchasing one of the best grade of taps, but breakage and production were out of all proportion. Upon investigation, we found his means of tapping was a makeshift, which required a skilled operator.

After seeing two taps broken and half an hour spent in removing them from the work, we told him by installing a Garvin Automatic Tapper he could first raise his production 300%; second, eliminate tap breakage; third, replace the skilled operator with a boy.

Being a hard-headed self-made business man, this was pretty big talk with him. He took us at our word. We installed the machine, and with a boy who had been in his shop only two weeks,- the first day his production was increased 415% without a tap being broken.

That one machine is now taking care of production that it formerly took six machines to do.

Now, Mr. Manufacturer, is this condition prevailing in your plant? Send us the enclosed card. It may be the means of your paying a larger dividend this coming year.

Yours for Increased Production,

THE GARVIN MACHINE CO.,

F. A. Bower.

Would you like a copy of the Automatic Tapper Circular?

THE GARVIN MACHINE COMPANY

Spring and Varick Streets — New York City

GARVIN

BUILDER OF BETTER MACHINE TOOLS

If interested tear out this page and place with letters to be answered.

CONTROLLING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

CONVERTERS, ROTARY
MacGovern & Co., Montreal, Que.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.

COOLERS, WITH DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

COPING MACHINES
Bertram & Sons Co., John, Dundas, Ont.
Dom. Steel Products Co., Ltd., Brantford
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Can. Blower & Forge Co., Kitchener.

COPPER, BUS BAR, SHEET, PLATES, RODS
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper and Brass Rolling Mills, New Toronto.

CORE OIL
Swan & Finch, Inc., 165 Broadway.

COUNTERBORES AND COUNTERSINKS
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Eclipse Counterbore Co., Ltd., Walkerville,
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.

COUNTERSINKS, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

COUNTERBORES, INVERTED, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

COUNTERSHAFTS
Almond Mfg. Co., Ashburnham, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Baird Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., Ltd., A. R., Montreal
Williams Mchy Co., A. R., Toronto.

COUPLINGS, FRICTION
Bernard Industrial Co., The A., Fortierville, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto.

COUPLINGS, RAPID HOSE
Ont. Machinery & Supply Co., Ltd., Montreal, Que.

COILING MACHINERY, WIRE AND SPRING
Garlock-Walker Machinery Co., Toronto.

BUCKET
Hanna & Co., M. A., Cleveland, O.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Cleveland Pneumatic Tool Co. of Canada, Toronto.

CRANES, OVERHEAD, HAND AND
Gardner, Rohl & Son, Montreal.
Independent Pneumatic Tool Co., Chicago

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Northern Crane Works, Walkerville.

ELECTRIC
Volta Manufacturing Co., Welland, Ont.

CUPS, OIL
Can. Winkley Co., Ltd., Windsor, Ont.

COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.

CRANES, GRAVITY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

CRANE RUNWAYS
MacKinnon Steel Co., Sherbrooke, Que.

CRANES, JIB
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, LOCOMOTIVE
Brown Hoisting Machinery Co., Cleveland, Ohio.
Holden Co., Ltd., Montreal, Que.

CRANES, GOLLIATH, PNEUMATIC AND PORTABLE
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane and Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Petrie, Ltd., H. W., Toronto.

CRANES, PILLAR
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy. Co., A. R. Toronto, Ont.

CRANES, TRAVELLING, ELECTRIC AND HAND POWER
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Oliver Engineering Co., Montreal.

CRANK SHAFTS
Can. Found's & Forgings Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.

CRANK PIN TURNING MACHINE
Herbert, Ltd., Alfred, Toronto, Ont.

CRIMPS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass.

CRUSHERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.

CUPOLAS
Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.

CURB PUMPS FOR OIL, GASOLINE
Bowser Co. Ltd., S. F. Toronto, Ont.

CURRENT TRANSFORMERS
Volta Manufacturing Co., Welland, Ont

CUT-OFF COUPLINGS, FRICTION
Petrie, Ltd., H. W., Toronto.

CUTTERS, BOLT
See Bolt Cutters.

CUTTERS, GEARS
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto

CUTTER HEADS
Oliver Machinery Co., Grand Rapids, Mich.

CUTTERS, PIPE (See Pipe Cutters)

CUTTERS, HIGH SPEED
Madison Mfg. Co., Madison, Wis.

CUTTERS, MILLING
Butterfield & Co., Rock Island, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Sply. Co., G. F., Montreal.
Garvin Machine Co., New York.
Ingersoll Mache. Co., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg. Co., Hartford, Conn.
Wilt Twist Drill Co., Walkerville, Ont

CUTTER RELIEVING MACHINES
Cleveland Milling Machine Co., Cleveland

CUTTING-OFF MACHINES
Armstrong Bros., Tool Co., Chicago.
Atkins & Co., E. C., Hamilton, Ont.
Bertram & Sons Co., John, Dundas.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
G. F. Foss Mchy. & Sply. Co., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass.
Kennedy & Sons, Wm., Owen Sound
Lyman Tube & Supply Co., Montreal, Que.
Niles-Bement-Pond Co., New York.
Prest-O-Lite Co., Inc., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Williams Tool Corp. of Canada, Ltd., Brantford, Ont.
Wells Bros., of Can., Galt, Ont.
Williams Mchy. Co., A. R., Toronto, Ont.

CUTTING COMPOUND AND CUTTING OIL
Cataract Refining Co., Ltd., Toronto.
Swan & Finch, Inc., New York.

CUTTING OIL, RECLAIMING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

CUTTING AND WELDING PLANTS
Davis-Bournonville Co., Jersey City, N.J.
Prest-O-Lite Co., Inc., Toronto, Ont.

CYANIDE AND LEAD BATH POTS
Swedish Crucible Steel Co., Windsor.

CYLINDERS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co. Hamilton, Ont.

REHUMIDIFYING
B. F. Sturtevant Co., Galt, Ont.

DERRICKS
Aikenhead Hardware Co., Toronto, Ont.
Dominion Bridge Co., Montreal.
Hepburn Co., Ltd., J. T., Toronto, Ont.
Morris Crane & Hoist Co., Sherbrook.

DIAMOND (BORTZ)
Furniss, Clarke & Co., Montreal, Que.

DIAMOND TOOLS
Can. Desmond-Stephan Mfg. Co., Hamilton.
Ford-Smith Machine Co., Hamilton, Ont.
Furniss Clark & Co., Montreal, Que.
Joyce-Koehel Co., Inc., New York City
Wheel Trueing Tool Co., Detroit.
Petrie Ltd., H. W., Toronto.

DIAMONDS, CARBON AND BORTZ
Joyce Koehel Co., Inc., New York, N.Y.
Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.

DIE CASTINGS
Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

DIE HEADS, AUTOMATIC
Greenfield Tap & Die Corp., Greenfield Mass.
National Acme Co., Cleveland, Ohio.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

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Crescent Mche. Co., Ltd., Montreal, P.Q.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Wells Brothers Co., of Canada, Galt.

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Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Brown, Boggs Co., Hamilton, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardiner, Robt. & Son, Montreal.
Herbert Ltd., Alfred, Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Jones & Lamson, Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Brothers of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DIES, HAMMERED
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, DROP FORGE.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, METAL STAMPING
Ackworthie Ltd., J., Birmingham, Eng.
Crescent Mche. Co., Ltd., Montreal, P.Q
Elliott & Whitehall, Galt, Ont.

DIES, PIPE THREADING
Ackworthie Ltd., J., Birmingham, Eng.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Landis Machine Co., Waynesboro, Pa.

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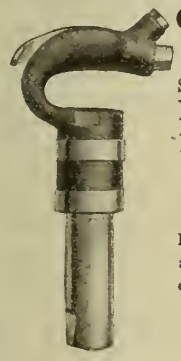
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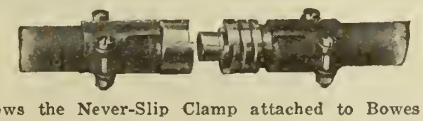
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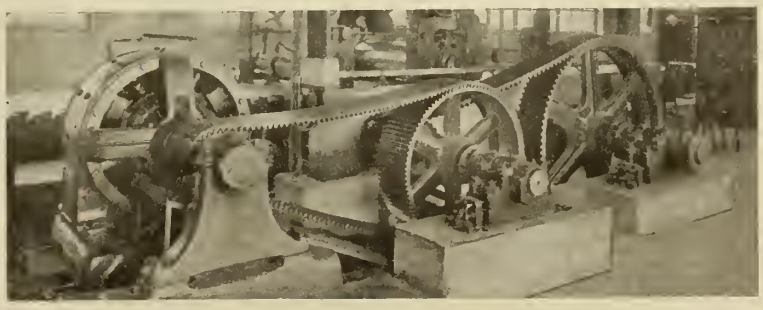
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W. S. Rockwell Co., New York, N.Y.
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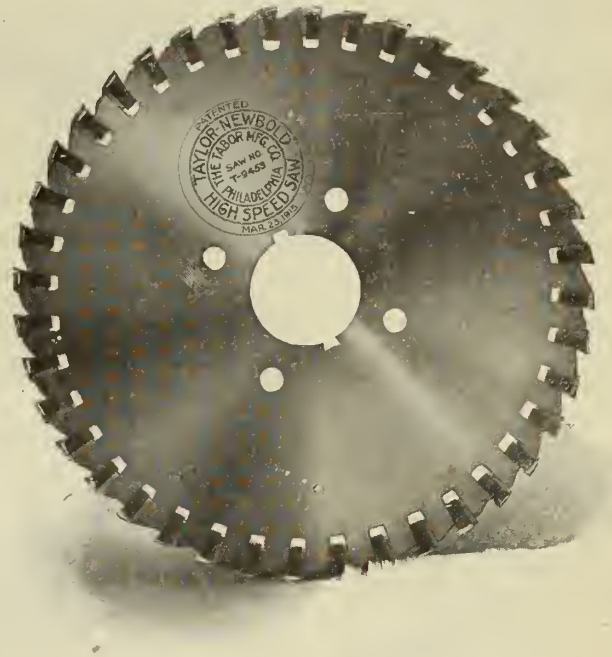
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Greenfield Tap & Die Corp., Greenfield.
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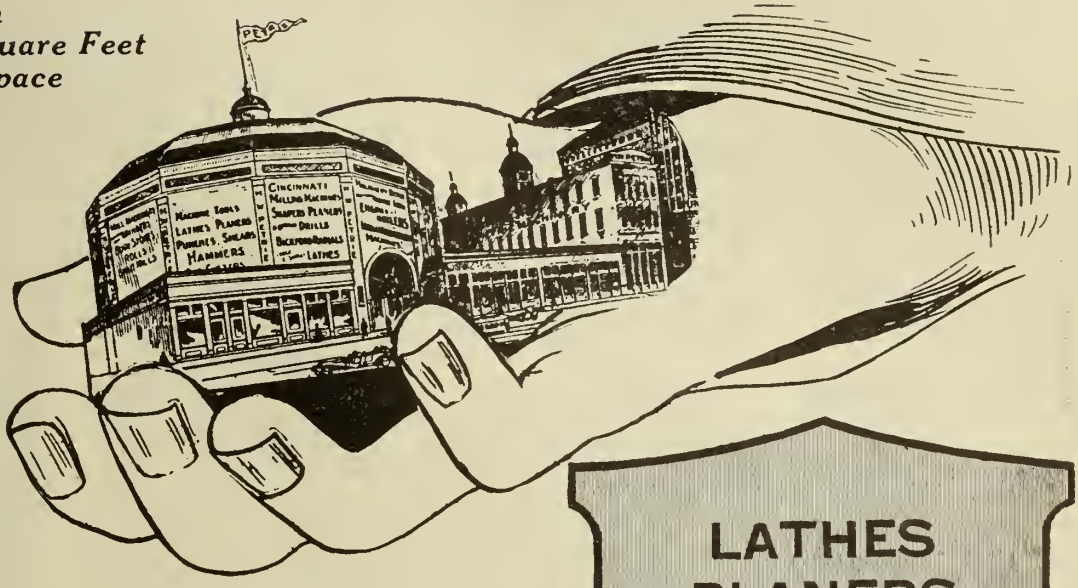
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Metalwood Mfg. Co., Detroit, Mich.
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INDEX CENTRES
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Petrie, Ltd., H. W., Toronto.

INDICATING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

INDUSTRIAL SITES
City of St. Johns, Quebec.

INGOTS, FORGING AND ROLLING
Electric Steel & Metals Co., Welland.

INSULATING COMPOUNDS
Robertson Co., Ltd., H. H., Sarnia, Ont.

IRON ORE
Hanna & Co., M. A. Cleveland, O.

IRON, WROUGHT, ROLLED, PIG
Swedish Steel & Impt. Co., Ltd., Montreal

JACKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
[illegible] Engineering Co.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.

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Lyman Tube & Supply Co., Montreal, Que.
Northern Crane Works, Walkerville.

JAWS, FACE PLATE
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford
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Crescent Mach. Co., Ltd., Montreal, P.Q.
Gishott Machine Co., Madison, Wis.
Globe Engineering Co., Ltd., Hamilton.
Jones & Lamson, Springfield, Vt.

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Canada Foundries & Forgings, Welland.
Dominion Foundries & Steel Ltd., Hamilton, Ont.

KEY SEATERS
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, M.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Machy. Co., A. R., Toronto.

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MacKinnon Steel Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

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LABORATORIES, INSPECTION AND TESTING (see Chemists)

LADLES, FOUNDRY
Northern Crane Works, Walkerville.

LACING MACHINES
Clipper Belt Lacer Co., Grand Rapids, M.

LAG SCREW GIMLET POINTERS
National Machy. Co., Tiffin, Ohio.

LATH
Robertson, Ltd., H. H., Sarnia, Ont.

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Acme Machine Tool Co,, Cincinnati, Ohio.
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LATHE CHUCKS (See Chucks)

LATHE DOGS AND ATTACHMENTS
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Hendey Machine Co., Torrington, Conn.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

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Herbert, Ltd., Alfred, Toronto, Ont.
National Acme Co., Windsor, Vt.

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Betts Mach. Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, BORING
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont

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Canadian Fairbanks-Morse Co., Montreal
Geo. F. Foss Machy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Seneca Falls Mfg Co., Seneca Falls, N.Y.
Strelinger Co., C. A., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Williams Mchy Co., A. R., Toronto, Ont.

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Canadian Fairbanks-Morse Co., Montreal.
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Garlock-Walker Machinery Co. Toronto.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
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R. McDougall Co., Galt.
Niles-Bement-Pond Co., New York.
Perfect Machine Co., Galt, Ont.
Standard Equipment & Tool Wks. Montreal, P.Q.
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Sidney Tool Co., Sidney, Ohio.
Strelinger Co., C. A., Windsor, Ont.
Walcott Lathe Co., Jackson, Mich.
A. R. Williams Machy. Co., Toronto
Williams Mchy Co., A. R., Toronto, Ont.

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Herbert, Ltd., Alfred, Toronto, Ont.
Intern'l. Mchy. Supplies Ltd., Montreal.

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Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

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Garlock-Walker Machy. Co., Toronto, Ont.

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Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & Sply Co., G. F., Montreal
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Lehman Machine Co., St. Louis, Mo.
Niles-Bement-Pond Co, New York.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Strelinger Co., C. A., Windsor, Ont.
Williams Machy. Co., A. R., Toronto.

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Lehman Machine Co., St. Louis, Mo.
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Strelinger, Chas. A. Co., Windsor, Ont.

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Herbert Ltd., Alfred, Toronto, Ont.

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Hoyt Metal Co., Toronto, Ont.

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Turner Brass Works, Sycamore, Ill.

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Graton & Knight Mfg. Co., Worcester, M

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See Belting, Chain.

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MACHINE TOOLS
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Foss Mchy. & S'ply Co. G. F., Montreal
Garlock-Walker Machy. Co. Toronto, Ont
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Machy. Co., A. R., Toronto.

MACHINERY GUARDS (See Guards)

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Globe Engineering Wks., Hamilton, Ont

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Crescent Machine Co., Ltd., Montreal, Que.
McClean Machine & Tool Co., Ltd., Hamilton, Ont.

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Starrett Co., L. S., Athol, Mass.

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Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
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Foss Mchy. & S'ply Co. G. F., Montreal
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Petrie, Ltd., H. W., Toronto.

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Quaker City Rubber Co., Philadelphia, Pa
International Mchy. Sply., Ltd., Montreal

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Pratt & Whitney Co., Dundas, Ont.

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Bowser Co., Ltd., S. F., Toronto, Ont.

MEASURING TAPES AND RULES
Chesterman & Co., Jas., Sheffield, Eng.

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Samuel Osborne (Can.), Ltd., Montreal.

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See Chemists.

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Oakley Chemical Co., New York, N.Y.

METAL CUTTING MACHINES
Atkins & Co., E. C., Hamilton Ont
Lyman Tube & Supply Co., Montreal, Que.

METAL SAWS
See Saws.

METAL SAWS, POWER
E. C. Atkins & Co., Inc., Indianapolis
Hoefer Mfg. Co., Freeport, Ill.
Lyman Tube & Supply Co., Montreal, Que.

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British Smelting & Refining Co., Ltd., Montreal, Que.
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Canada Metal Co., Toronto, Ont.
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
Hoyt Metal Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.

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Can. Winkley Co., Ltd., Windsor, Ont.

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Bowser Co., Ltd., S. F., Toronto, Ont.
General Combustion Co., Ltd., Montreal, Que.

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Taylor, J. A. M., 518 Stair Bldg., Toronto.
Petrie, Ltd., H. W., Toronto.

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Elec. Steel & Metals, Welland, Ont.

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Atkins & Co., E. C., Hamilton, Ont.

MILLS, SAND
Frost Mfg. Co., Chicago, Ill.

MILL MACHINERY
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Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee Wis.
Strelinger, Chas. A. Co., Windsor, Ont.

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Bertram & Sons Co., John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence R.I.
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Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Hendey Mach. Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.

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Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Betts Machine Co., Rochester, N.Y.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.

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Delore Smelting & Refining Co., Ltd. Toronto, Ont.
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Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

MILLING MACHINES, HAND
Bristol Machine Tool Co., Bristol, Conn.

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Pratt & Whitney Co., Dundas, Ont.
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Standard Equipment & Tool Wks., Montreal, P.Q.
Strelinger, Chas. A. Co., Windsor, Ont.

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Bertram & Sons Co., John, Dundas, Ont
Canada Machinery Corp., Galt, Ont.
Cochrane-Bly Co., Rochester, N.Y., U.S.A
Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Herbert, Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rockford Milling Mach. Co., Rockford, Ill
Strelinger, Chas. A. Co., Windsor, Ont.
United States Mach. Tool Co., Cincinnati.
Williams Machy. Co., A. R., Toronto

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Gooley & Edlund, Inc., Cortland, N.Y.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
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Strelinger, Chas. A. Co., Windsor, Ont.

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Strelinger Co., C. A., Windsor, Ont.
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Brown & Sharpe Mfg. Co., Providence.
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Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Garlock-Walker Machy. Co., Toronto, Ont.
Toronto.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Sturtevant Co., B. F., Galt, Ont.
Volta Mfg. Co., Welland, Ont.
Williams Mach'y Co., A. R., Toronto.

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Holden Co., Ltd., Montreal, Que.

MOULDS, RUBBER

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Dominion Steel Products Company, Ltd., Brantford, Ont.

MULTIPLE INDEX CENTRES

Garvin Machine Co., New York.
Graton & Knight Mfg. Co., Worcester, M.

MULTI-DRILLING, MULTI-BORING, MULTI-TAPPING MACHINERY.

Nat. Automatic Tool Co., Richmond, Ind.

MUNICIPALITIES

City of St. John, Quebec.

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NAME PLATES, BRONZE, ETCHED AND STAMPED

Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS

Can. Driver-Harris Co., Ltd., Walkerville.

NICKEL

Pilot Steel & Tool Co., Montreal, Que.

NICKEL STEEL

See Steel.

NICKEL SILVER—SHEETS, ROLLS, PLATES and RODS

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Landis Machine Co., Waynesboro, Pa.
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NITROGEN

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Canada Machinery Corp., Galt, Ont.
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Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

OILERS

All-Way Oiler Mfg. Co., Toronto, Ont.

OIL SEPARATORS

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Carborundum Co., Niagara Falls, N.Y
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Norton Co., Worcester, Mass.
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International Mach. Spis., Ltd., Montreal
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co., Philadelphia, Pa

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Frost Mfg. Co., Chicago, Ill.

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Can. Link-Belt Co., Toronto, Ont.
Gutta Percha & Rubber, Ltd., Toronto.
MacKinnon Steel Co., Sherbrooke, Que.

PARTITIONS, WIRE

See Guards

PAPER MILL MACHINERY

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto
Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

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Petrie, Ltd., H. W., Toronto.
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PATTERN MAKERS' LATHES

See Lathes.

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Steel Co. of Canada, Ltd., Hamilton, Ont

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Morrow Screw & Nut Co., J., Ingersoll, Ont

PINS, BELT-LACING

Clipper Belt Lacer Co., Grand Rapids.

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International Malleable Iron Co., Guelph.

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Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
McDougall Co., R., Galt.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

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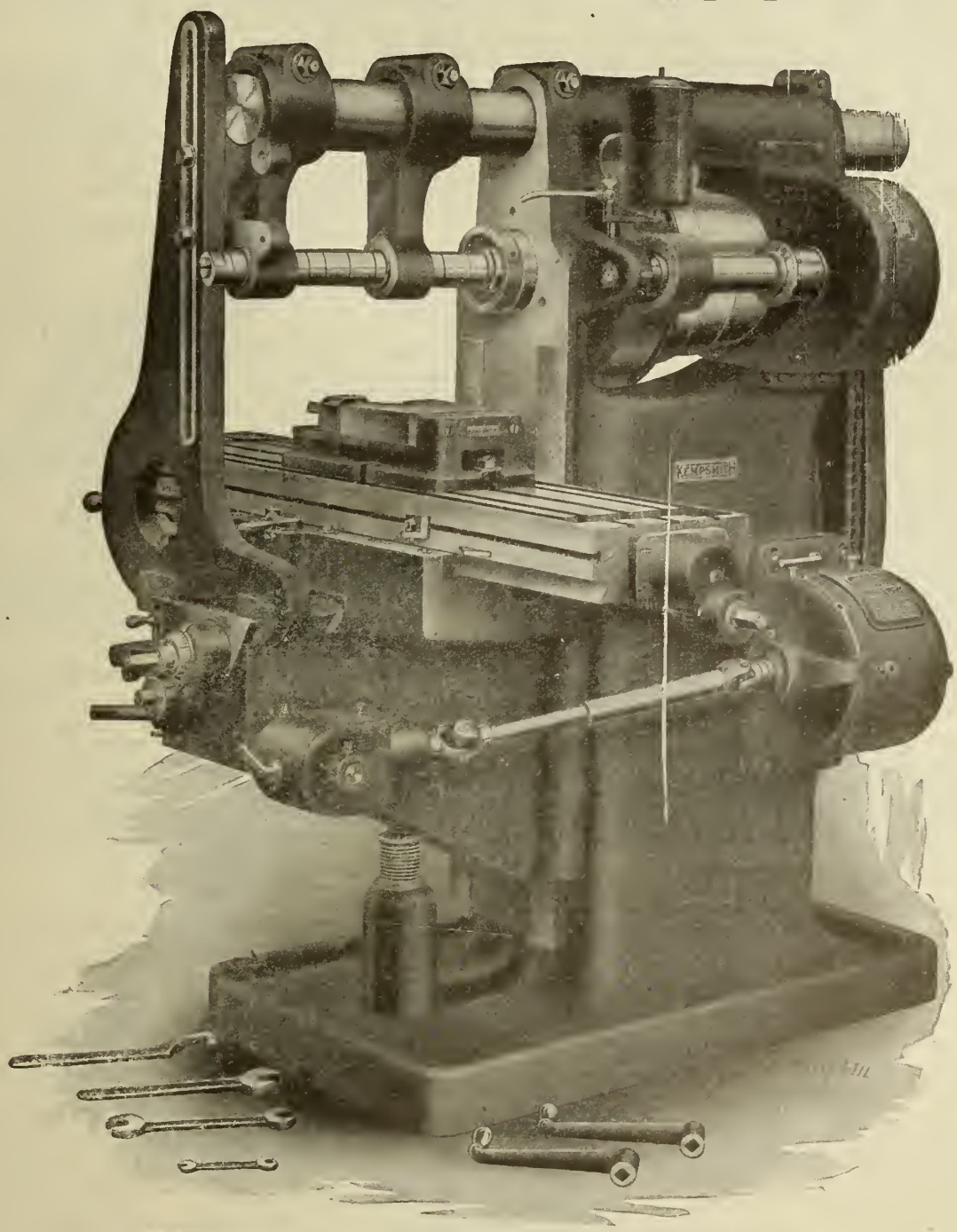
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A. B. Jardine & Co., Hespeler.
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Petrie, Ltd., H. W., Toronto.
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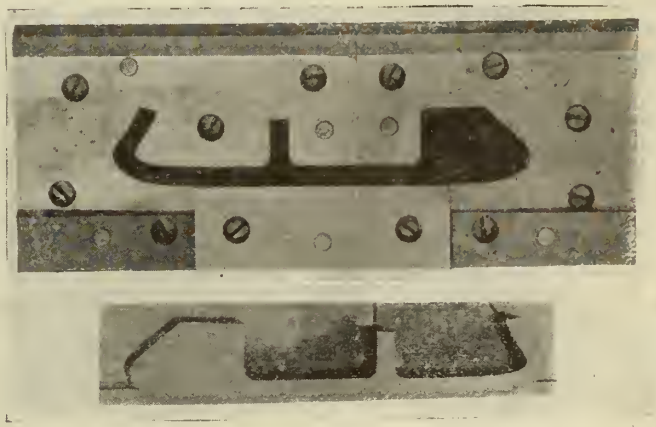
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Niles-Bement-Pond Co., New York.
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Garlock-Walker Machy. Co., Ltd., Toronto
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National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
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Strelinger, Chas. A. Co., Windsor, Ont.

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Can. Driver-Harris Co., Ltd., Walkerville.

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J. Morrow Screw & Nut Co., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

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Prest-O-Lite Co., Inc., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

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Hoyt Metal Co., Toronto, Ont.
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Ford-Smith Machine Co., Hamilton, Ont
Garlock-Walker Machinery Co., Toronto
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Globe Engineering Co. Ltd., Hamilton.
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Katie Foundry, Galt, Ont.
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.
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Mesta Machine Co., Pittsburgh, Pa.
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SAW BENCHES
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Brown, Boggs, & Co., Hamilton, Can.
Canada Machinery Corp., Galt, Ont.

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Marshall, Son & Bunney, Toronto

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Firth & Sons, Thos., Montreal, Que
Latrobe Electric Steel Co., Latrobe, Pa
Lincoln Electric Co. of Canada, Ltd Toronto, Ont.
Marshall, Son & Bunney, Toronto.
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Samuel Osborne (Can.), Ltd., Montreal
Vanadium-Alloys Steel Co., Pittsburgh

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STEEL CHROME VANADIUM
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Atkins & Co., Ltd., Wm. Sheffield, Eng
Marshall, Son & Bunney, Toronto
United Alloy Steel Corp., Canton, Ohio.

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Firth & Sons, Ltd., Thos., Montreal,
Lyman Tube & Supply Co., Ltd., Montre
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng
Marshall, Son & Bunney, Toronto
United Alloy Steel Corp., Canton, Ohio.

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Davidson Mfg. Co., Ltd., Montreal, Que.
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Kennedy & Sons, Wm., Owen Sound
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Nova Scotia Steel & Coal Co., Windsor
Swedish Crucible Steel Co., Windsor.

STEEL, COLD DRAWN
United Alloy Steel Corp., Canton, Ohio.

STEEL, COLD ROLLED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Drawn Steel Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
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STEEL, ELECTRIC FURNACE
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STEEL FJAB
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STEEL, NICKEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
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The Secretary, City Council

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MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd, Toronto.

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Toronto Iron Works, Ltd., Toronto.

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Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

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Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
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A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Murchy Machine & Tool Co., Detroit.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
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Strelinger, Chas. A. Co., Windsor, Ont.
Williams Tool Corp. of Can. Ltd., Brantford, Ont.

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Geometric Tool Co., New Haven.
Ingersoll Mach. Co., Ingersoll, Ont.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Victor Tool Co., Waynesboro, Pa.

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Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
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Atkins & Co., Ltd., Wm., Sheffield, Eng.
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Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
Wells Bros. of Can., Galt, Ont.

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Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

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Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Fess Mchy. & Sply. Co., G. F., Montreal.
Geometric Tool Co., New Haven.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Morse Twist Drill & Mchy. Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
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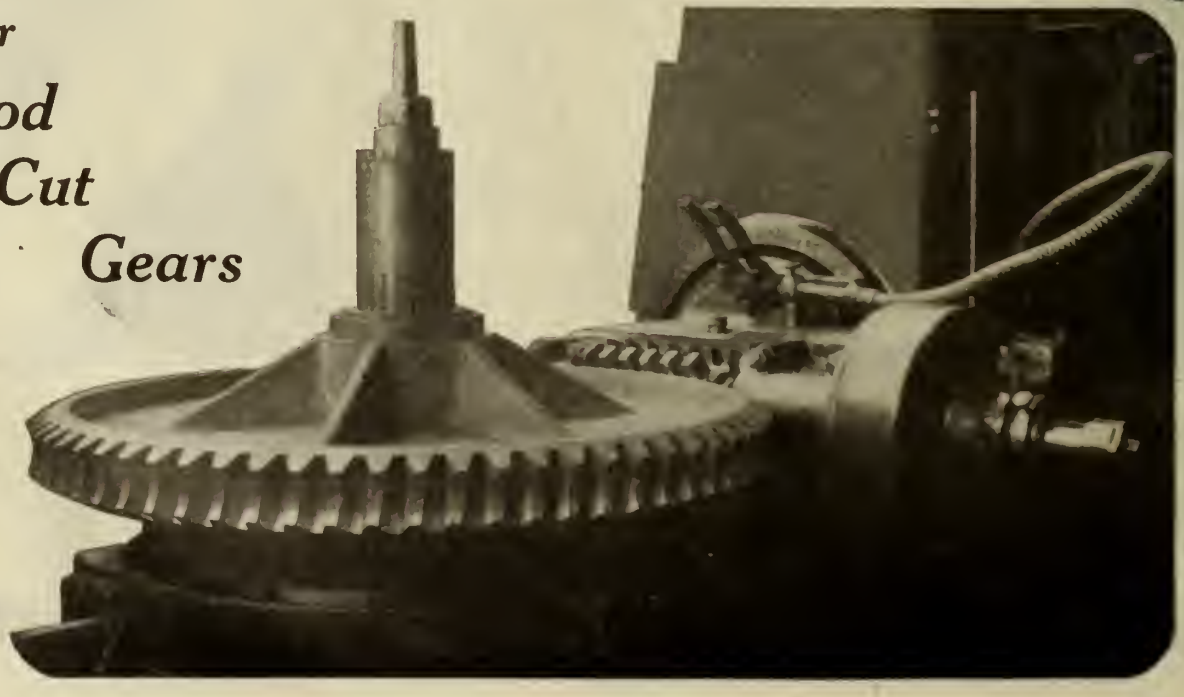
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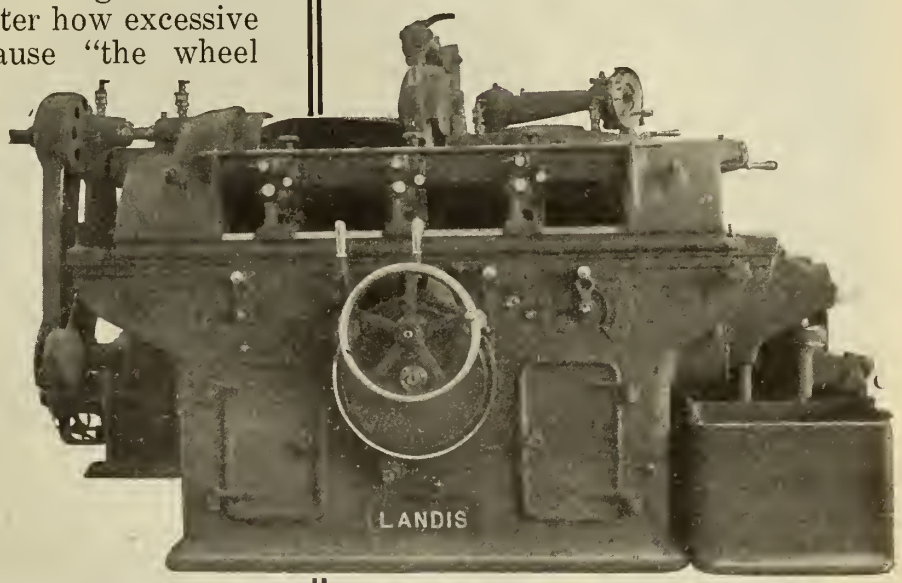
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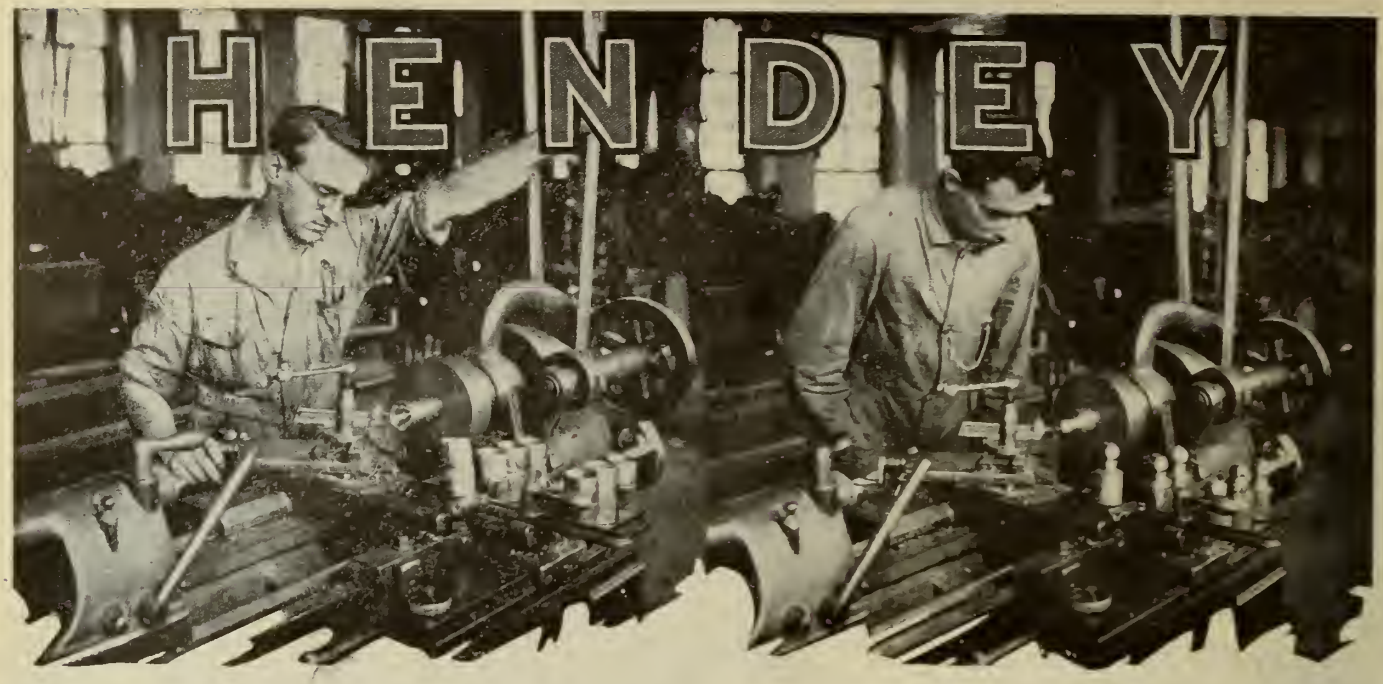
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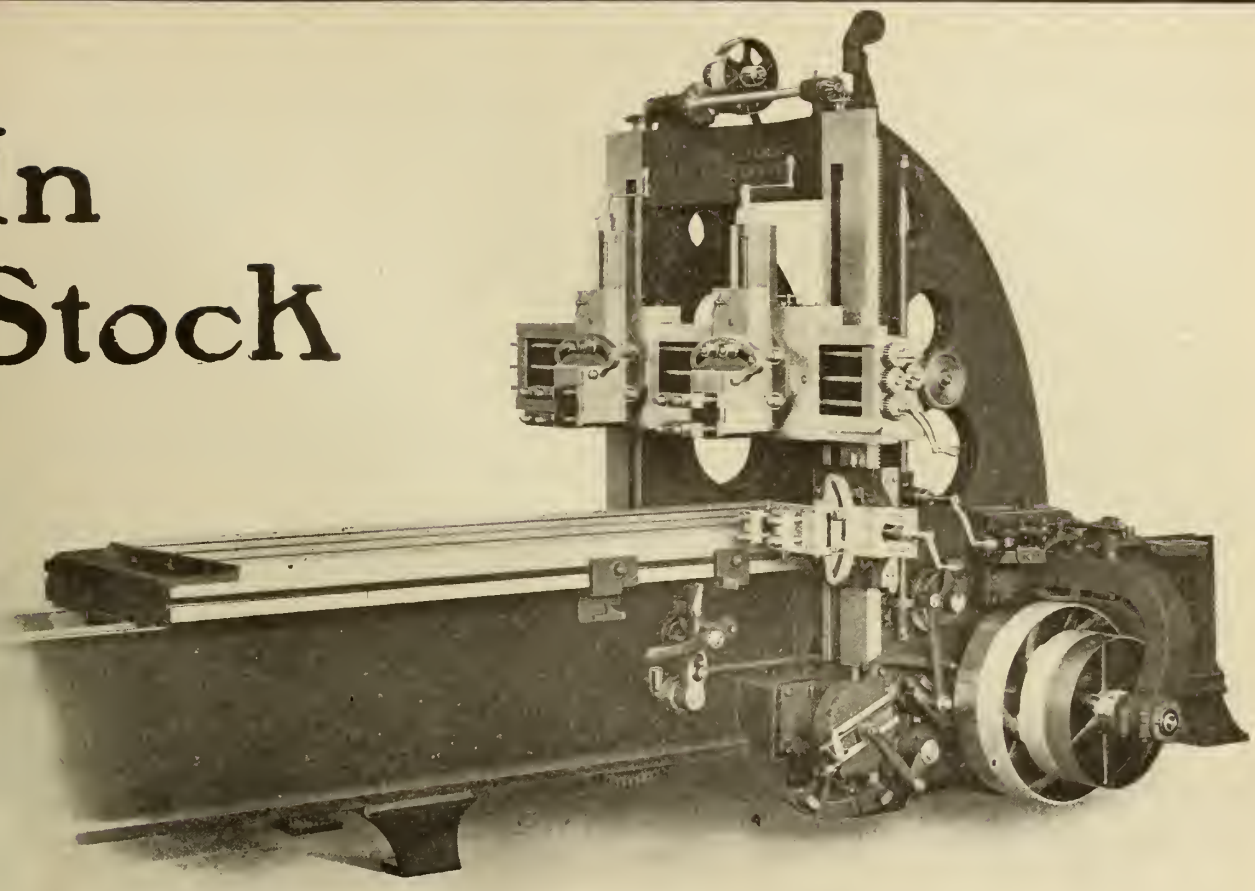
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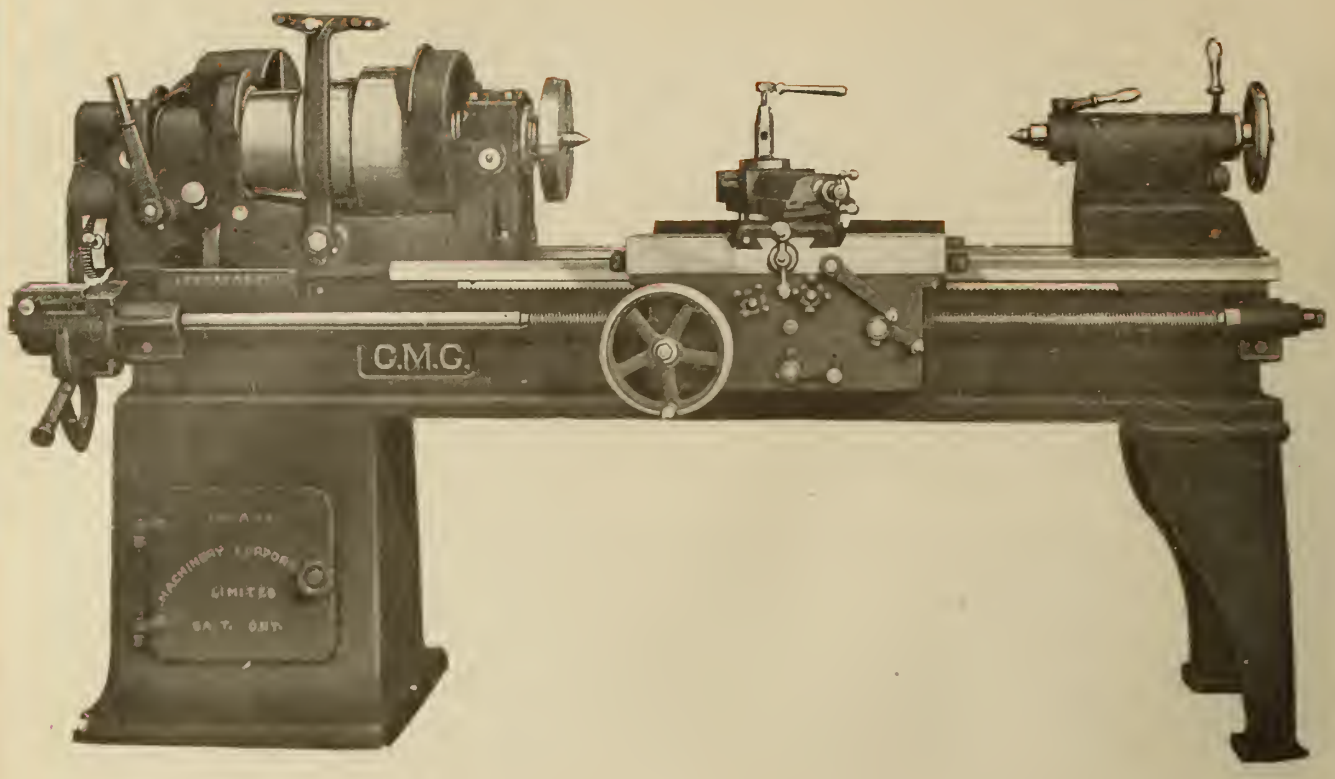
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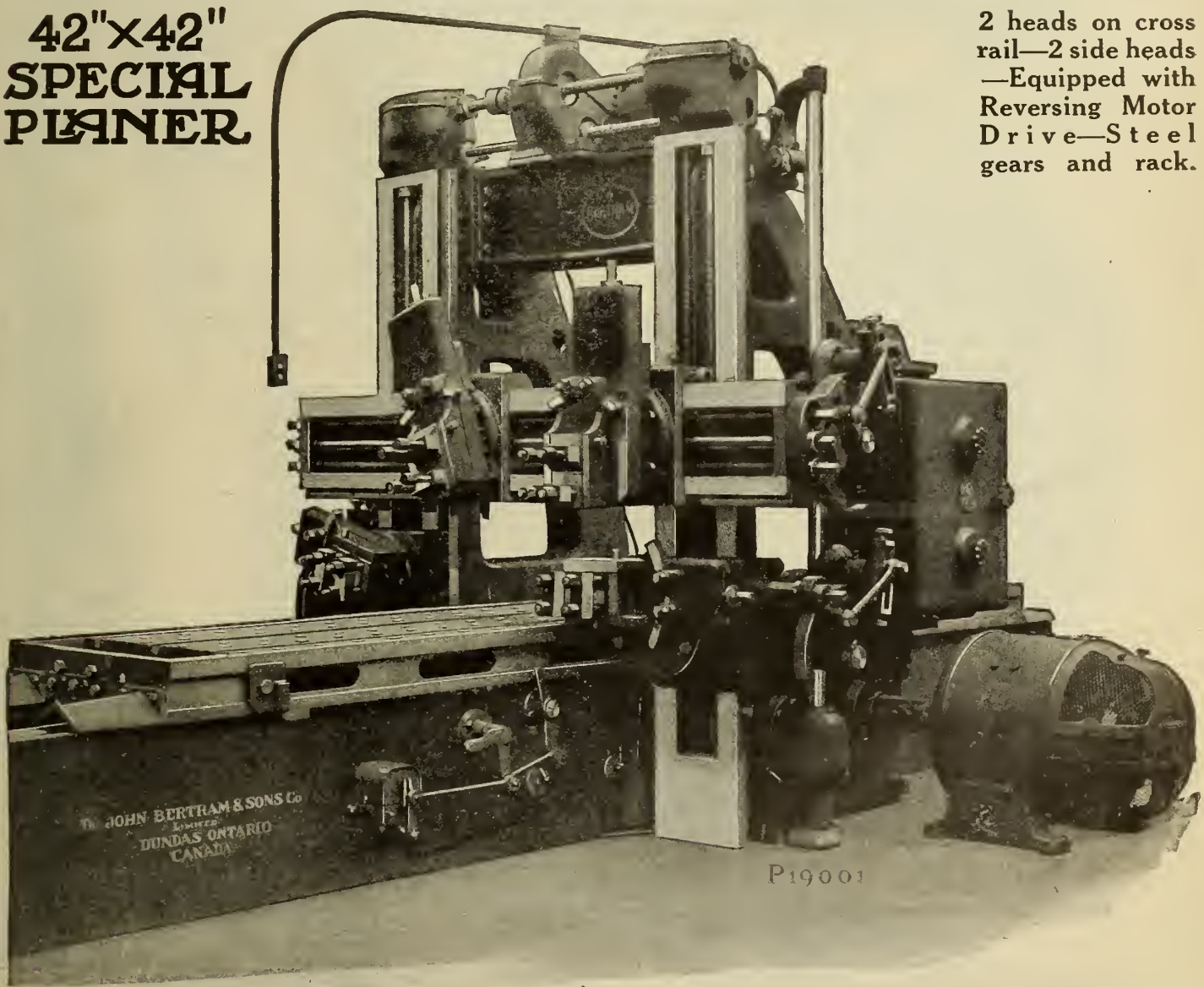
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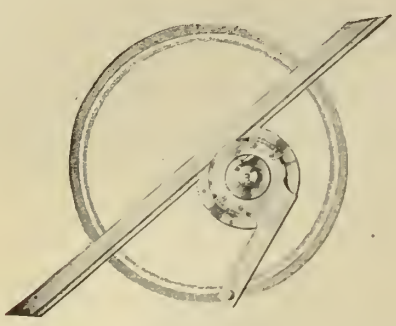
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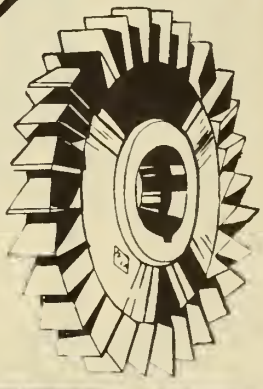
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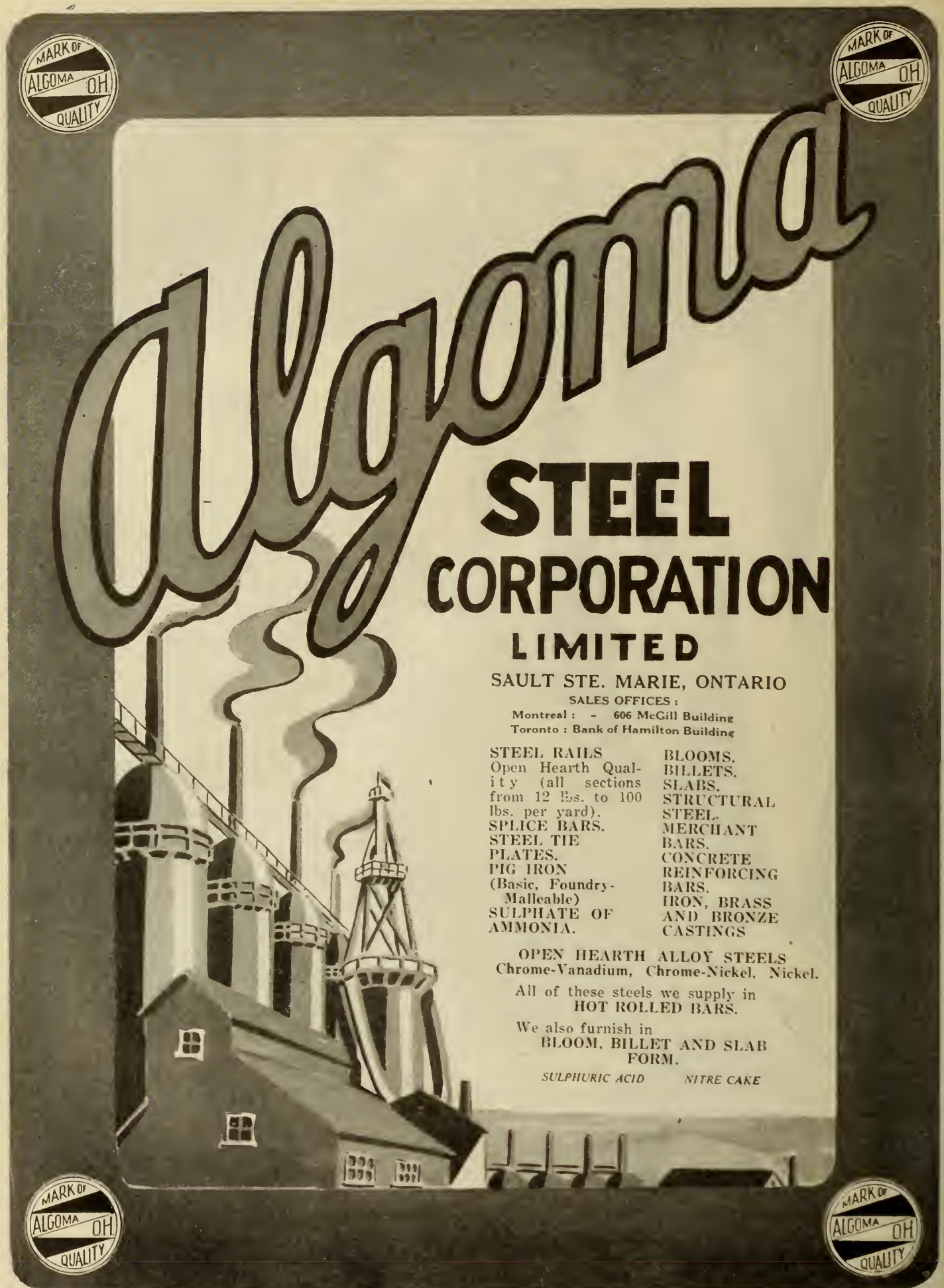
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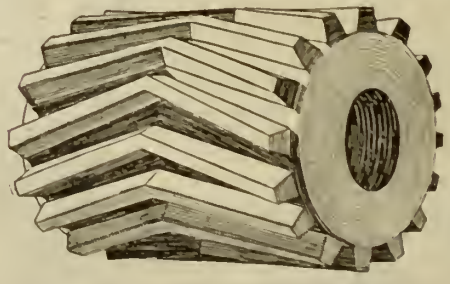
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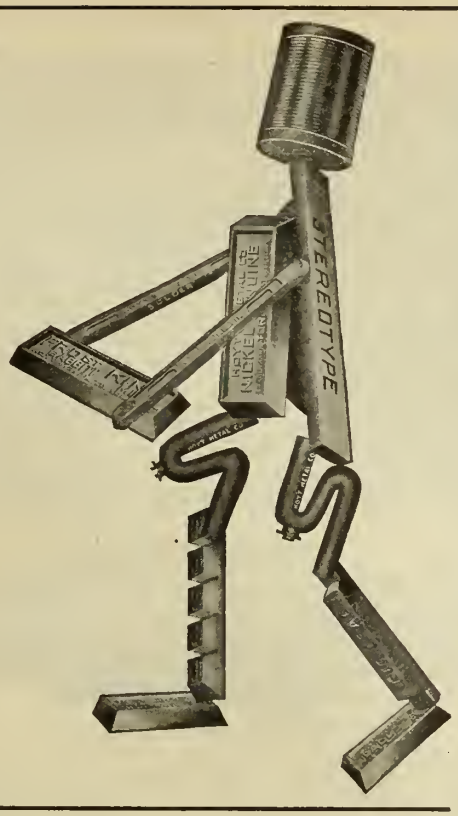
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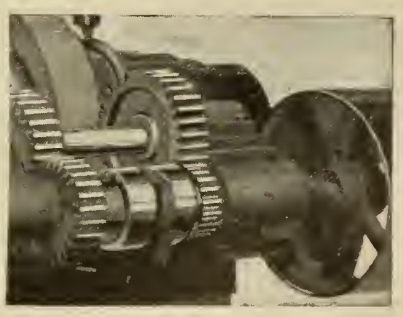
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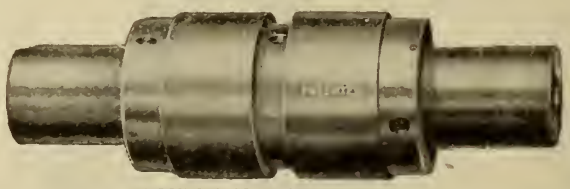
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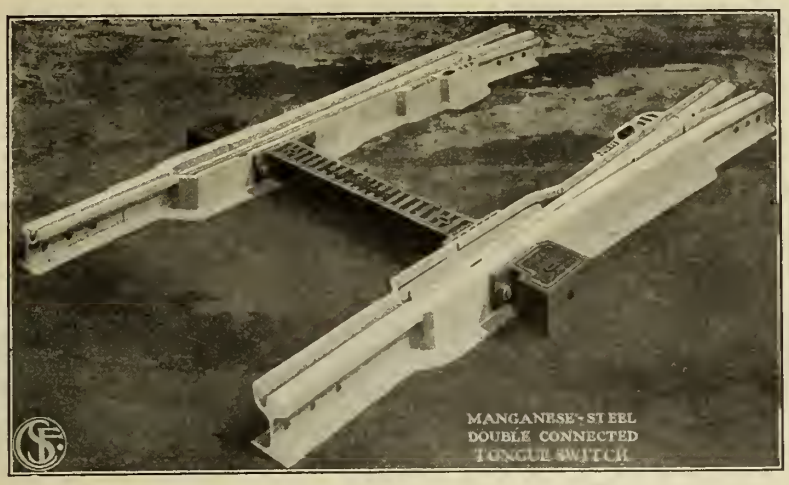
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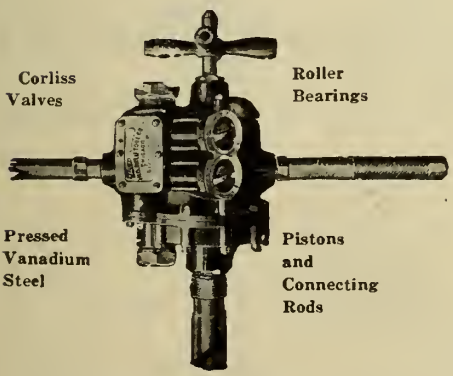
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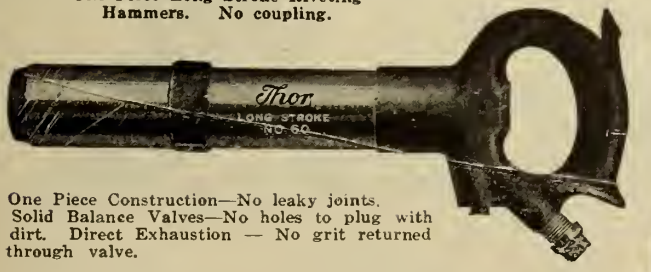
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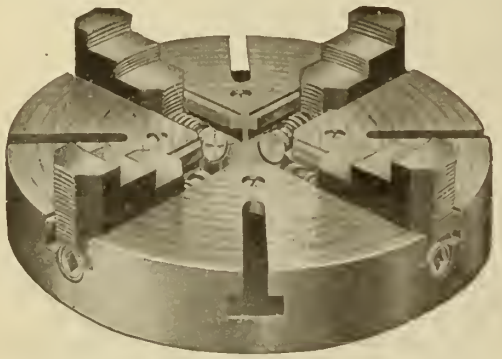
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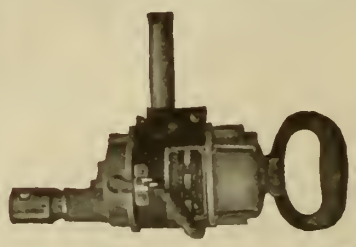
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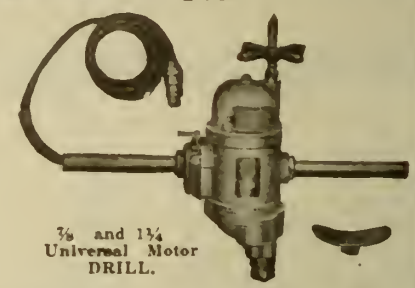
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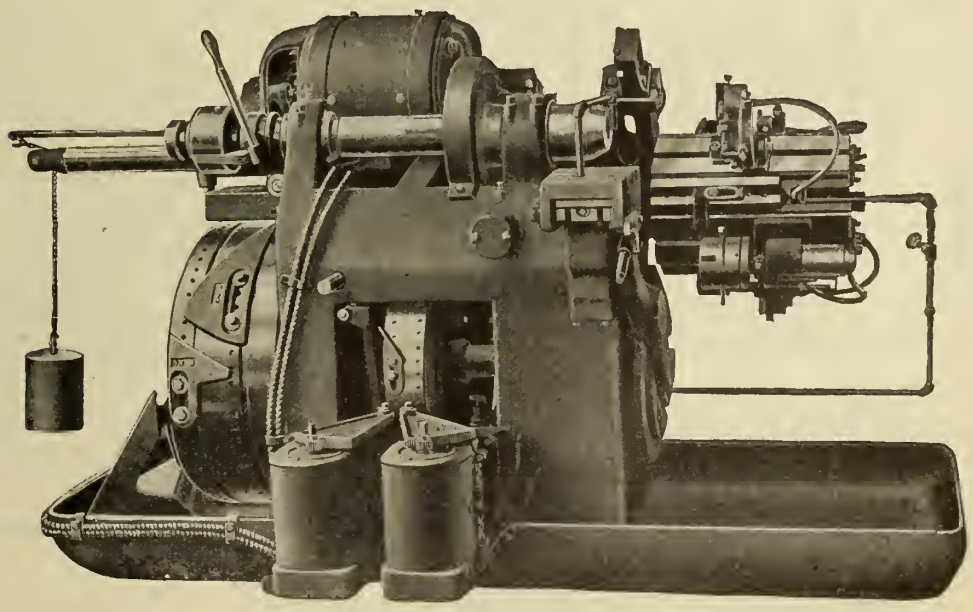
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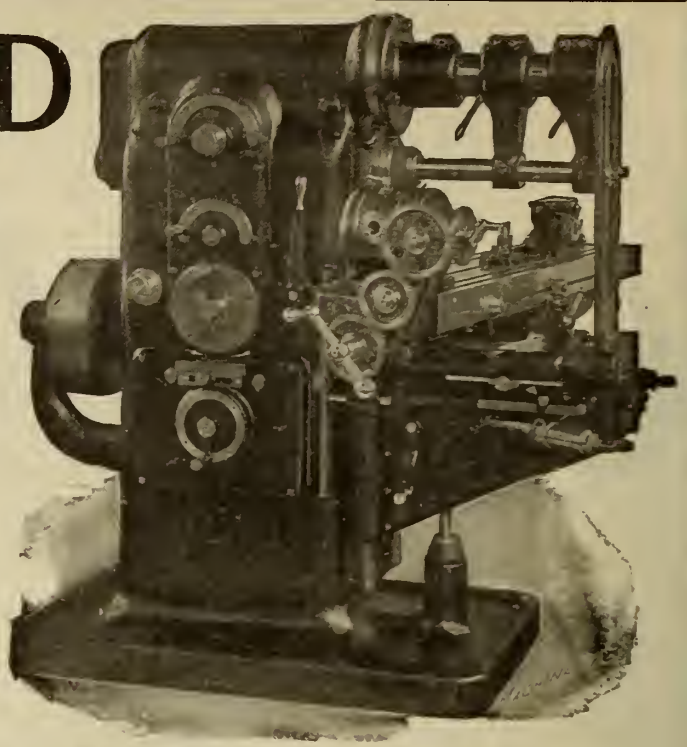
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Crucible
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Tool Steel
"ARGO" BRAND *HIGH-SPEED* STEEL

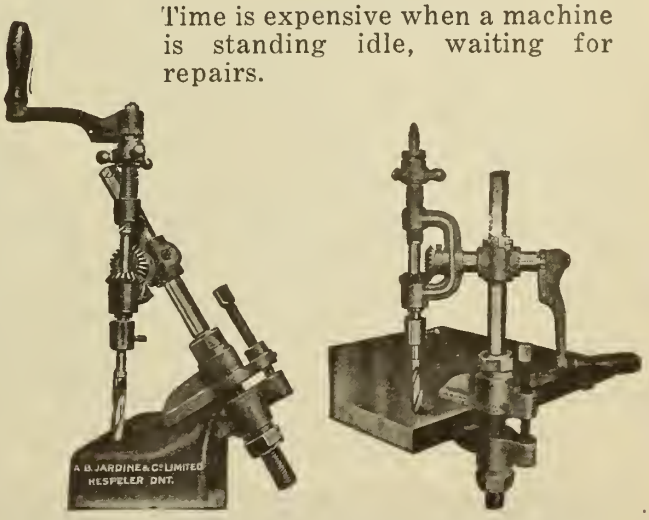
The John Illingworth Steel Co.
1856

Frankford, Phila.
New York Office 217 Broadway

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124 Craig St. W.
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Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.

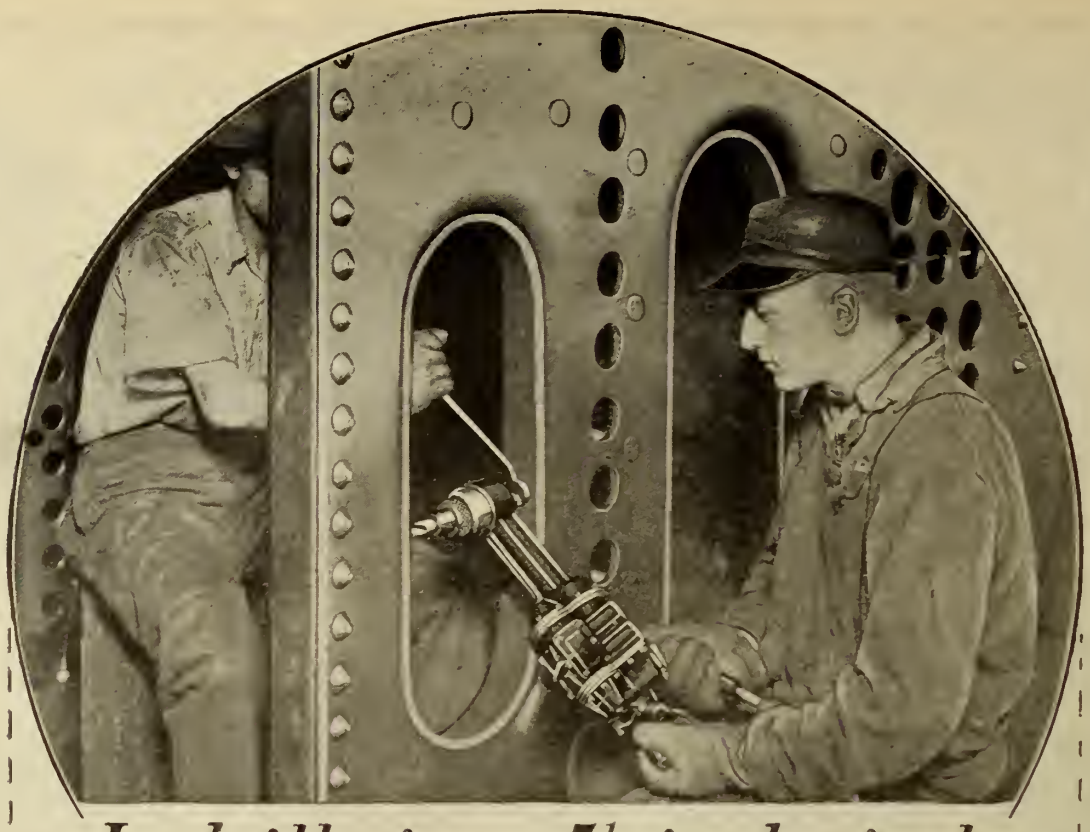


On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited
HESPELER, ONTARIO

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← *It drills in a 5½-inch circle* →

ANALYSIS shows two reasons why these men needed the No. 3 Little Giant Close Quarters Air Drill.

No other type or size machine will drill holes up to ⅞-inch in cramped spaces like this. This drill, when equipped with a No. 1 Square Taper Socket, can drill inside of a 5½-inch circle.

Extended gear case and bevel gear-driven spindle properly proportion speed and power.

Hard-to-get-at places are easy for this Little Giant with its light weight, ease of control and midget compactness. At every angle the work is visible. Accurate, rapid work logically follow.

This No. 3 is but one member of a big, busy Little Giant Air Drill family, where every drilling need is met.

Bulletin 598, sent upon request, describes the complete line for drilling, reaming, tapping, flue rolling, etc.

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P-60 H

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LITTLE GIANT

The World's Standard Air Drill

Makes Every Machine Tool A Bigger, Better Producer

NO matter what the nature of the machine tool may be—Link-Belt Silent Chain Drives should increase its production and better its product.

The power is transmitted gently, yet positively. There is no slippage as with leather belts. And yet the sudden application of power on heavy cuts is thoroughly cushioned. For Link-Belt Silent Chain Drives are "flexible as a belt—positive as a gear—more efficient than either."

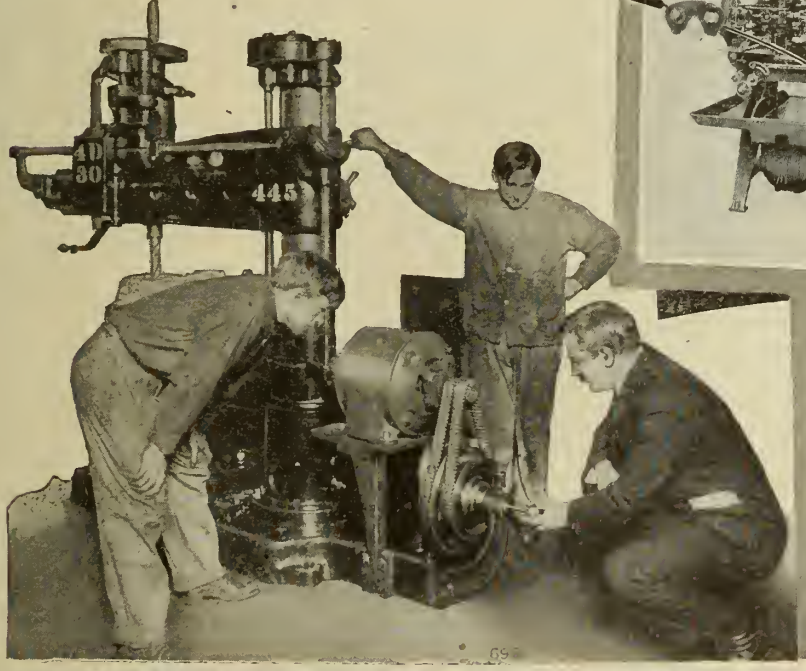
They permit short center drives, convenient location of driving parts and any speed reductions desired. They are 98.2% efficient—proven so by actual tests.

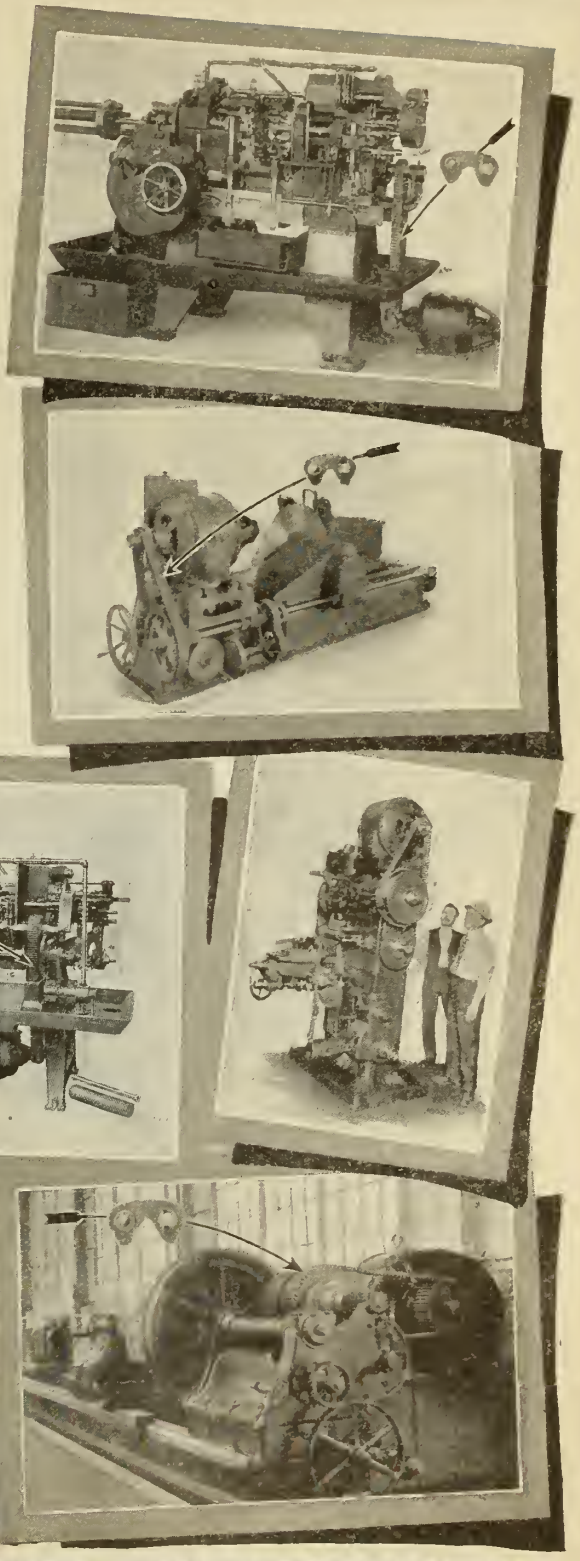
Our Machine Tool Book No. 312 gives details. Send for a copy.

200

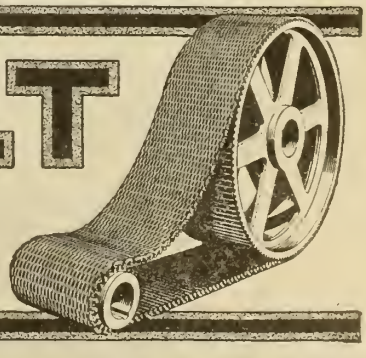
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LINK-BELT
SILENT CHAIN
FOR POWER TRANSMISSION



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To the Man With an Industry to Locate



The City of St. Johns Quebec

Deserves Your First Consideration

ITS LOCATION on the Richelieu River (27 miles from Montreal) provides the city with a direct water route to the Eastern Seaboard of the United States and the Great Lakes. Its commanding position in relation to the important markets of Canada and the United States assures economy and dispatch in the assembling of raw materials and distribution of the finished product.

POWER. A plentiful supply of power is developed at Chambly, eleven miles north-east of the city and distributed in St. Johns at rates that will compete with any city or town in Canada. Excellent railway connections assure a satisfactory coal supply.

TRANSPORTATION. Seven railroads, including Canada's two great transcontinental lines, run through the city. St. Johns obtains lower freight rates than any other centrally-located point on the continent.

LABOUR. St. Johns is known as the cheapest labour market in Canada. Skilled and unskilled labour is always plentiful and labour troubles are unknown.

In addition to the natural advantages of St. Johns as a location for a new industry the city greatly reduces the initial expense and difficulties of organization by granting many extraordinary inducements and concessions.

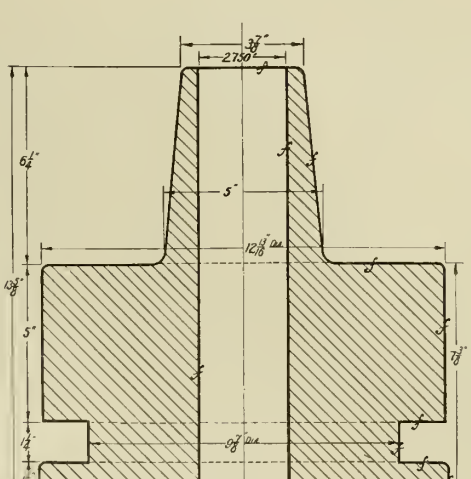
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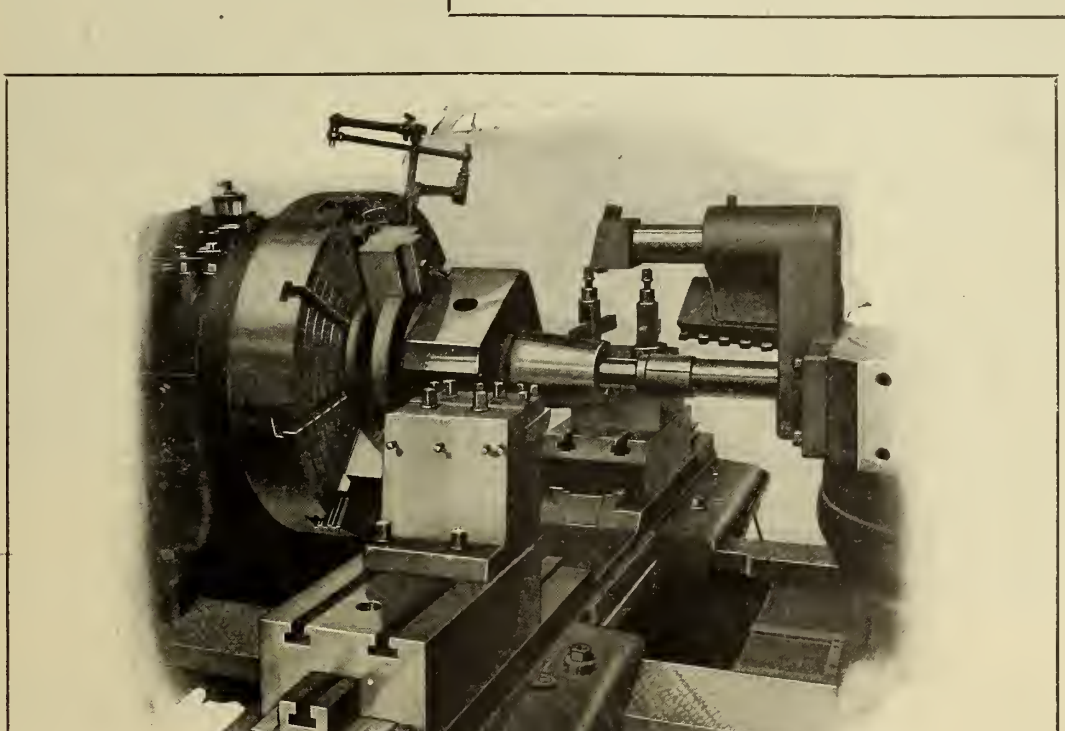
The Secretary of the City Council

St. Johns, Quebec, Canada

The Production of CAST IRON TURRETS

The production of Cast Iron Turrets on the 8-B Automatics is worth comparing with your method of producing parts. Write and send your blueprints along and we will gladly furnish time estimate.





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ROELOFSON MACHINE & TOOL CO., LIMITED

Head Office and Show Room:

11 Wellington Street East—TORONTO, CANADA

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The Automatic Double-Roll Feed

on this "BLISS" No. 69-N Cam Drawing Press makes possible an output of 3500 rod-ends per hour for Simmons Brass Beds, while the operator sits back and takes it easy. The stock used is 18 gauge, 3 inch strip brass.

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E. W. Bliss Company

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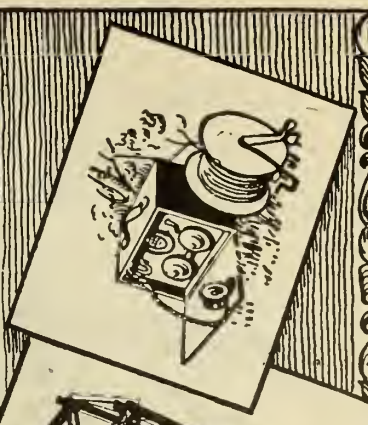
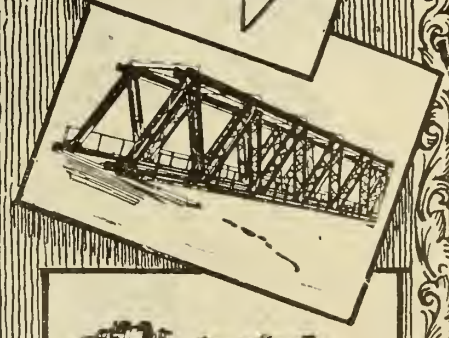
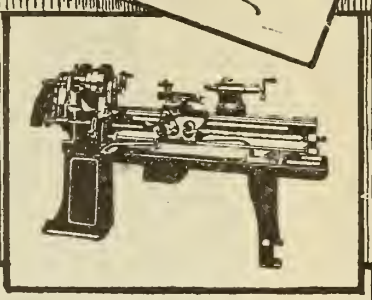
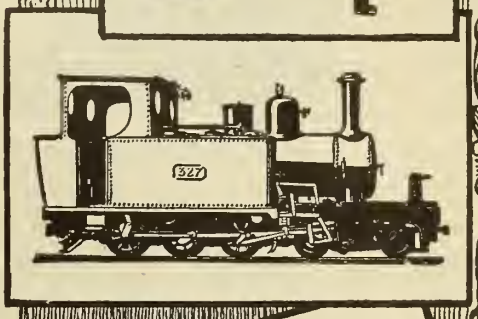
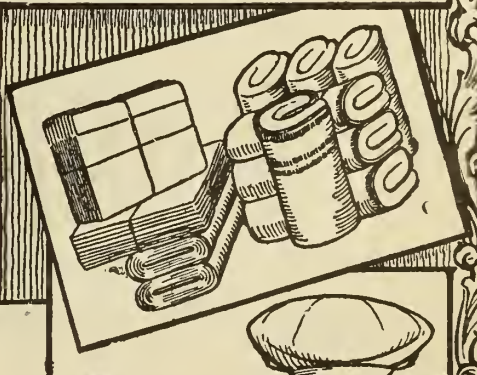
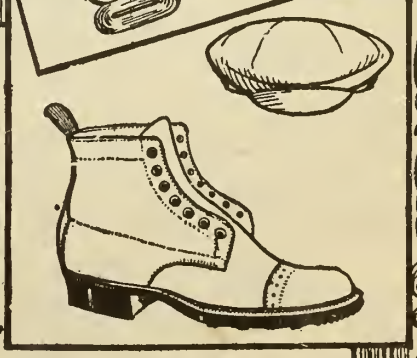
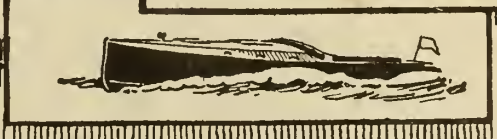
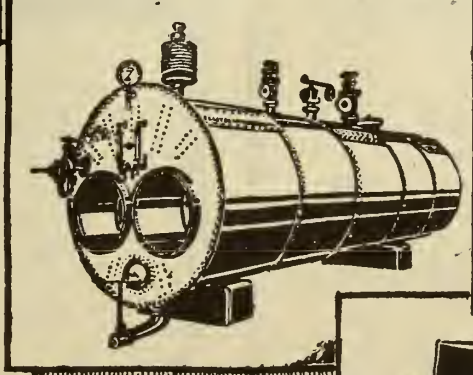
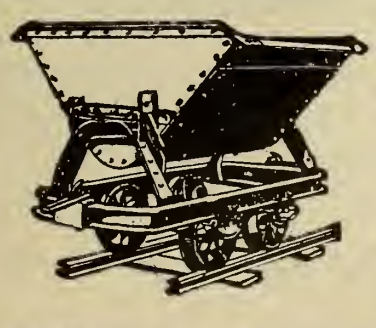
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WHEN THINKING OF BELTING KEEP IN MIND THAT

The back of the Ox



is the part where the fibre of the hide is tightest and unaffected by the action of breathing, therefore the most suitable to produce a dead straight and practically stretchless belt.

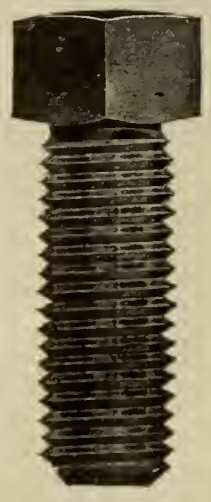
Tullis
LEATHER BELTING
COLUMBIA BRAND

is made entirely from this portion of the hide.

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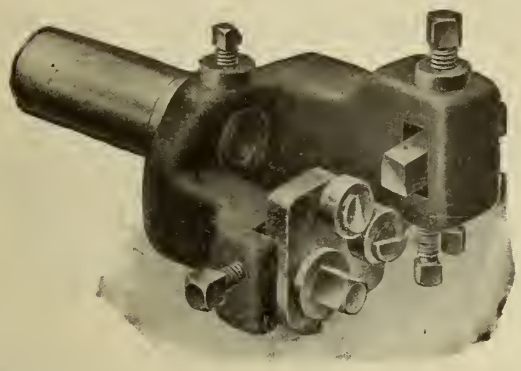
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GALT MACHINE SCREW CO., LIMITED
GALT, ONTARIO

Eastern Representatives: The Canadian B. K. Morton Company Limited, 49 Common St., Montreal, Que.

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FOR TRUEING GRINDING WHEELS
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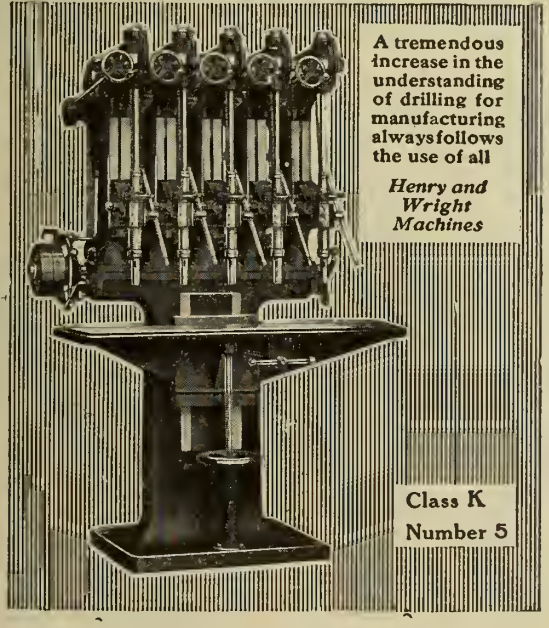
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COMPLETE EQUIPMENT FOR CAPSTAN LATHES FULLY ILLUSTRATED IN OUR TOOL LIST E.

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The Henry & Wright Mfg. Co.
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Throw it away, therefore, and buy a new one.

It is folly to allow workmen to keep on working with files that have become the least bit dull.

You waste their time and energy, and spoil the work.

Specify one of the following brands when ordering and get maximum service:

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Sheet Metal and Tinsmithing Work. Wood and Metal Patterns—Tools, Jigs and Fixtures to make Engineering and Drawing Work.

Our experts with long experience on general, special and repair machine shop work, together with one of the most modern equipped shops in Canada, ensure first-class quality with quantity at fair costs. Rubber mill equipment is our specialty.

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Prompt and careful attention given to inquiries.

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We stock in Montreal Free Turning Brass and Bronze Rods, suitable for high speed Turning both in Round and Hexagon.

We shall also be pleased to quote for shipments direct from Birmingham, shipping in two weeks' time.

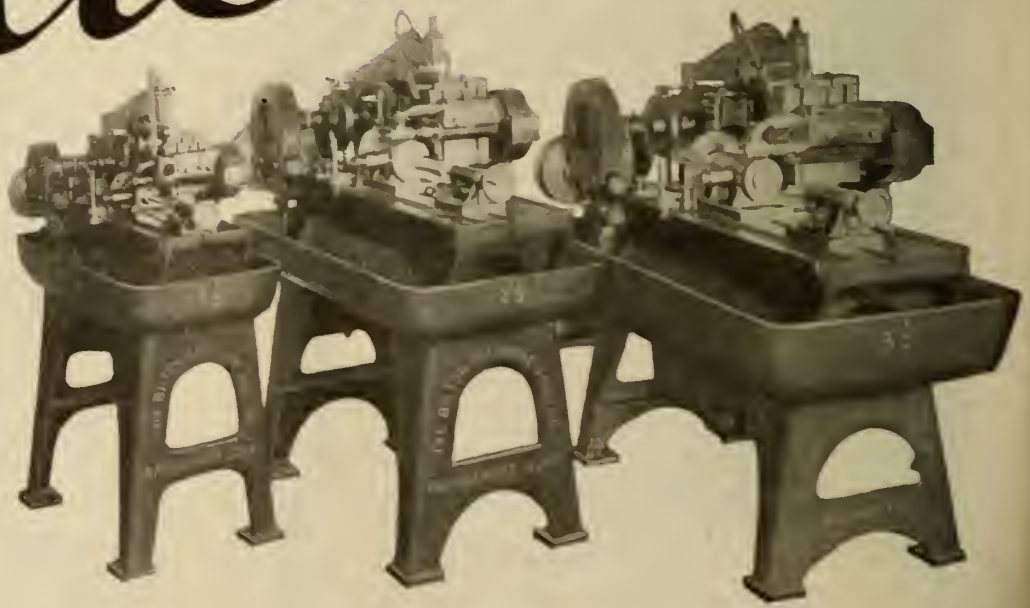
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We excel in quantity production

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Fully Automatic

Their adaptability is almost unlimited on small work—such as cutting spur, bevel, miter, angle gears, saws, ratchets, sprockets, cutters, knurls, taps, cylinders, form cutting, manufacturing, milling, etc.

A big time saver, as indexing takes place during return stroke of cutter — which is removing metal 90% of the time.

Write us for Catalog 30-6

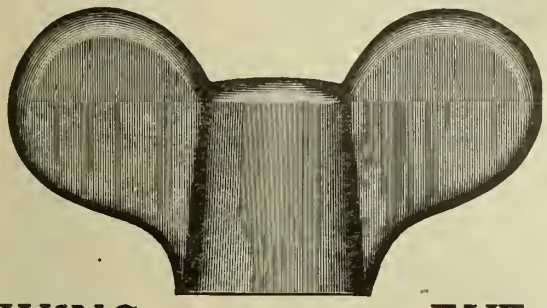
Over 500 leading manufacturers now use the Bilton for high production on accurate work

Bilton Machine Tool Co. Housatonic Avenue Bridgeport, Conn., U.S.A.

Foreign Agents: Alfred Herbert, Ltd. Chas. Churchill & Co., Ltd.

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DROP FORGED STEEL



WING NUTS

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BABBITT METALS



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Genuine

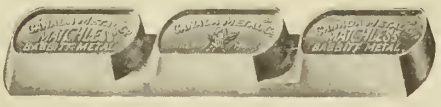
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THE
BABBITT METAL
WITHOUT A FAULT

For Donkey Engines, Saw Carriages, Small Motors, Transmission Line Shafting and all steady heavy pressure duty.



Matchless

Suitable For Slow-Moving Bearings

THE CANADA METAL CO., LIMITED
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Economical and Efficient Power Transmission



LANDIS
BORING
Machine

THE motor on Landis Boring Machines is mounted on the top of the column and is **direct connected to the main drive shaft,** thus eliminating fully 50 per cent. of all motor trouble.

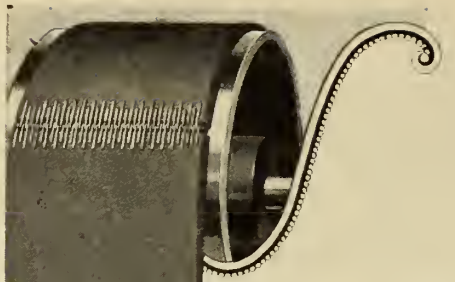
Belting, gearing and shifting, and the resulting loss of power, due to friction, are eliminated.

Constant speed motors of either direct or alternating current may be used.

Other outstanding features which have helped give the Landis Boring Machine its present prestige are fully described in our catalog. Send for a copy.

LANDIS
Tool Company
Waynesboro, Pa.

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"Clipper Laced Belts Run True"

IN LACING a belt with the "Clipper" lacing tool, the hooks are pressed zig-zag into the belting material. The long and short arms alternate, scientifically distributing the strain evenly over the entire width of the belt. Countless tests have proved that transmission belts laced the "Clipper" way run absolutely true. The hinge-joint, flat, smooth and flush with the belt on both sides, hugs the pulley and transmits the full horse-power. Any plant worker can use the simple "Clipper" Belt Lacer successfully and do the job speedily.

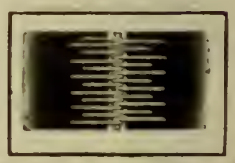
The Clipper Belt Lacer
Laces a Belt in Three Minutes

Old methods took from fifteen minutes to half an hour to make a crude, rough joint. The simplicity of the lacing operation, the smoothness and strength of the joint, its safety, durability and economy, have brought universal adoption of the "Clipper" wherever transmission belts are used. It is perpetually guaranteed and goes to responsible parties for free trial.

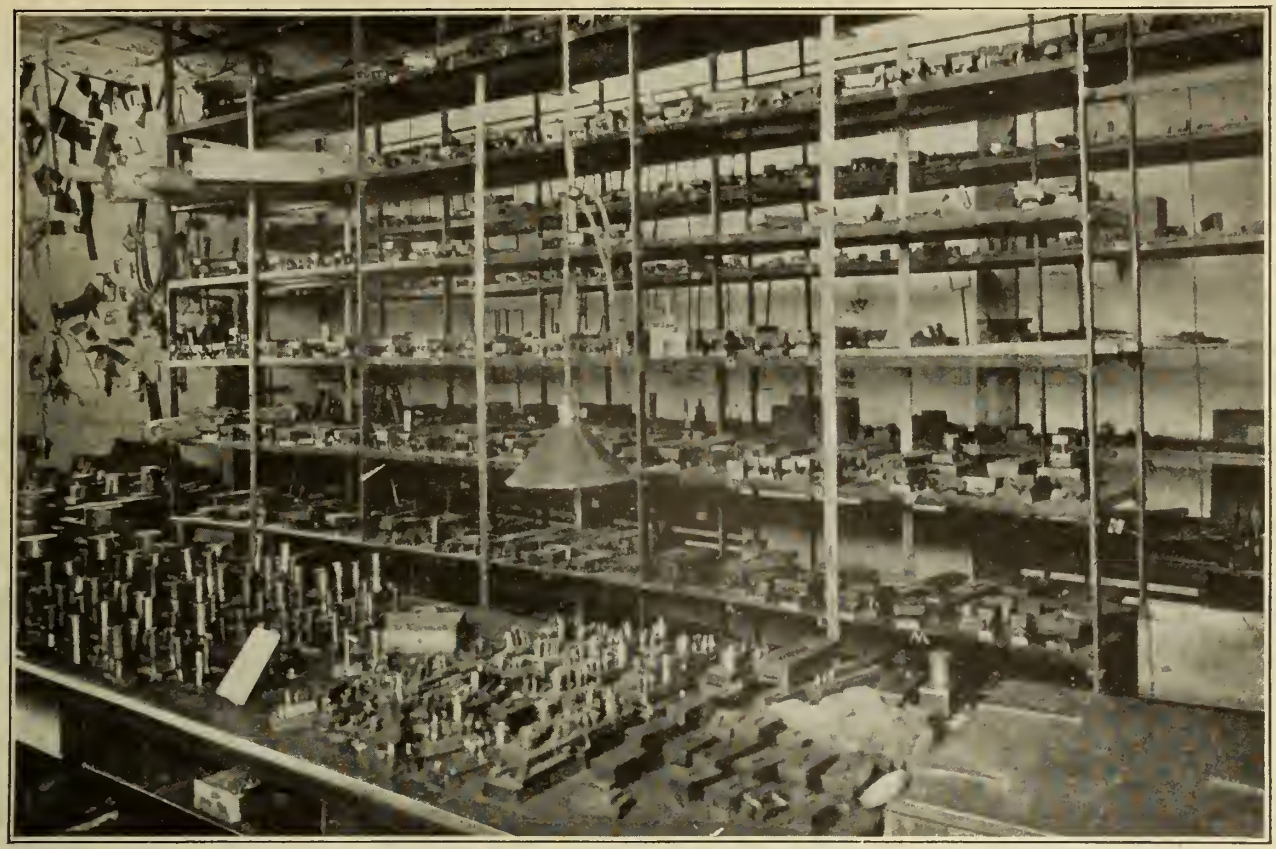


Most mill supply houses sell the "Clipper." Dealers not stocking it write for particulars.

"The Connecting Link Between Power and Production"



Clipper Belt Lacer Company
GRAND RAPIDS, MICHIGAN, U. S. A.



One of twelve Die Vaults containing $200,000 worth of tools

Special Tools for Special Springs

ORDERING *"Barnes-Made"* Springs insures *better springs,* and often quicker deliveries and reduced cost. The Wallace Barnes Co. has an accumulation of special tools acquired through over 60 years' spring manufacturing. Therefore we are often able to make up a special order of springs practically entirely by the use of tools already in stock. Think of the advantage this gives us and you over the fellow who has no such storehouse. This is just one part of our service.

Springs of steel, brass, phosphor bronze or vanadium —flat, coiled, spiral —compression, extension or torsion. Wireforming, spring washers, small parts of steel, brass, etc., in any finish. Assemblies. High Carbon Cold-Rolled Steel.

Ask a brother P.A. what *"Barnes-Made"* means to him. Or better yet, try *"Barnes-Made"* Springs yourself on your next spring order.

The Wallace Barnes Co.

"Spring Makers for Three Generations"

Main Office and Works: Bristol, Conn.

Western Sales Division: Book Bldg., Detroit

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STARS WIN *3 to 0*
over nearest competitors

The report produced above is typical of the way Star Hack Saws prove their superiority when a careful comparison is made of either hard or power blades.

B. Mfg. Co. P.——Pa. 8/19/20

"Bought some Star hand blades and reported F & L blades very poor. Had been using X blade* and claimed it was much better than Star. I asked man to make cuts with Star, tried blades on angle iron and blade cut fine. He tried to find a hard piece and finally found one he said X blade would not cut. I made three cuts with one Star blade and they admitted best work they ever saw. Also tried power blade for them with fine success. Gave F & L order for Star hand blades and will use Star on power as soon as needed."

** the blade we recognize as being our nearest competitor*

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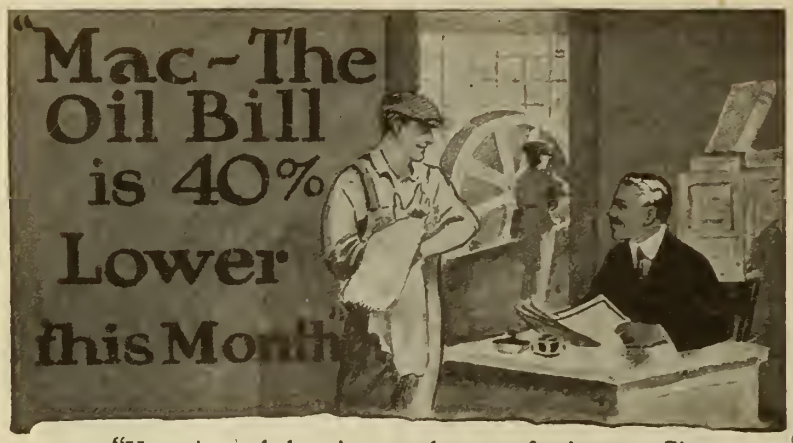
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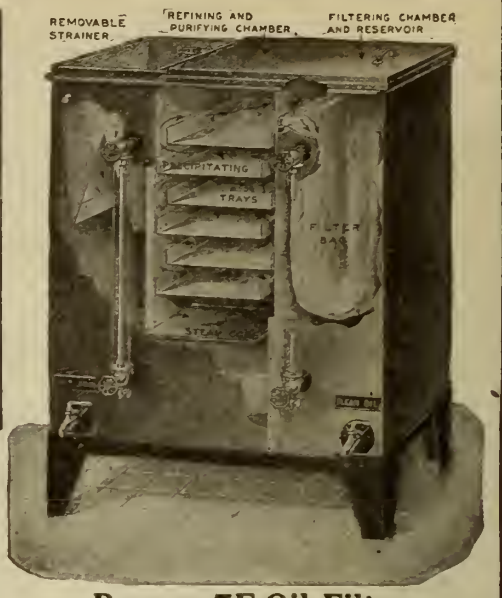
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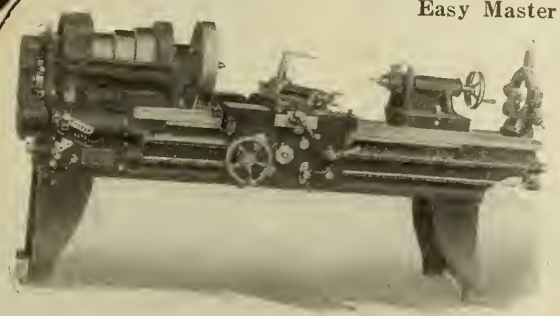
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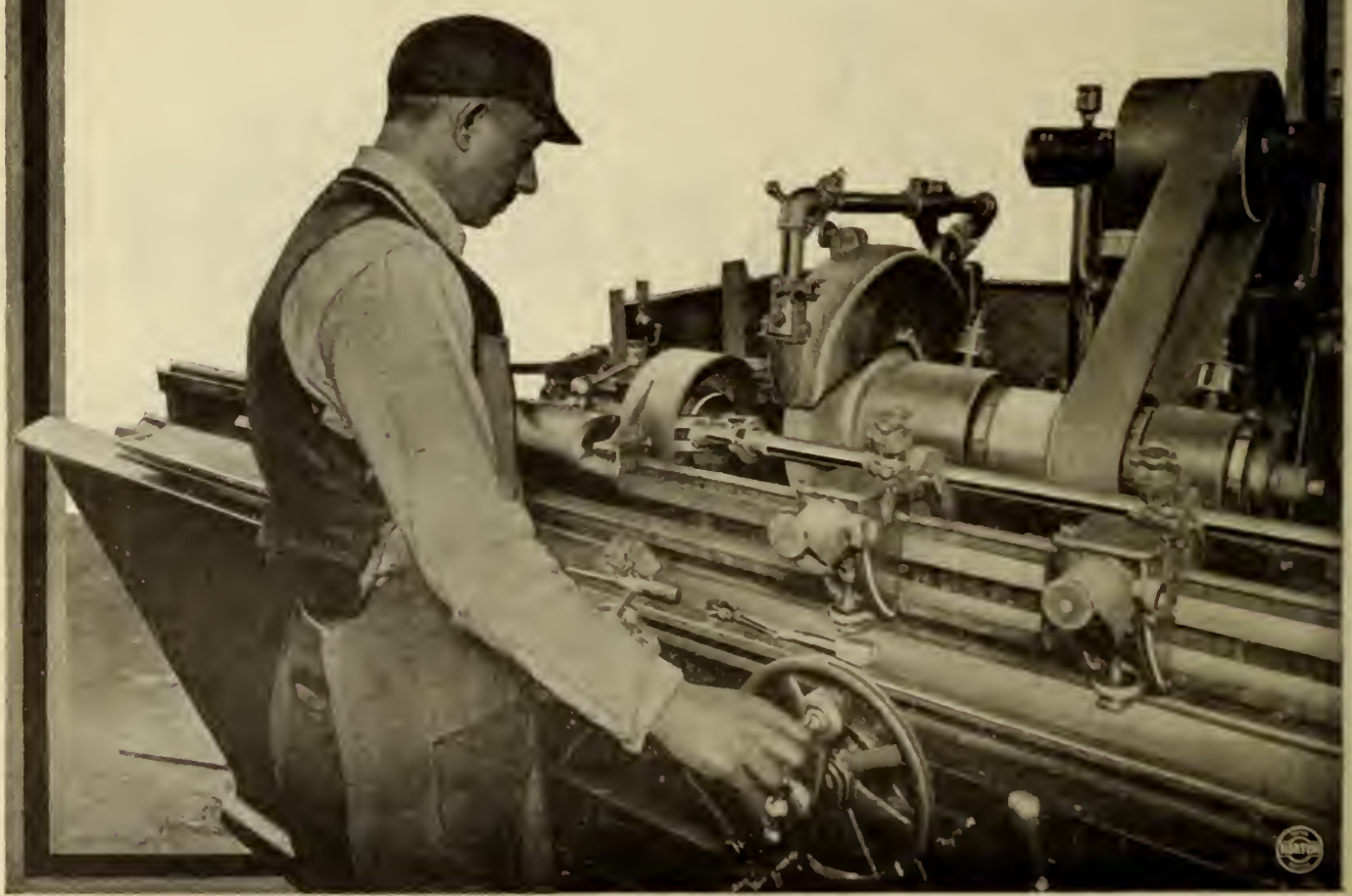
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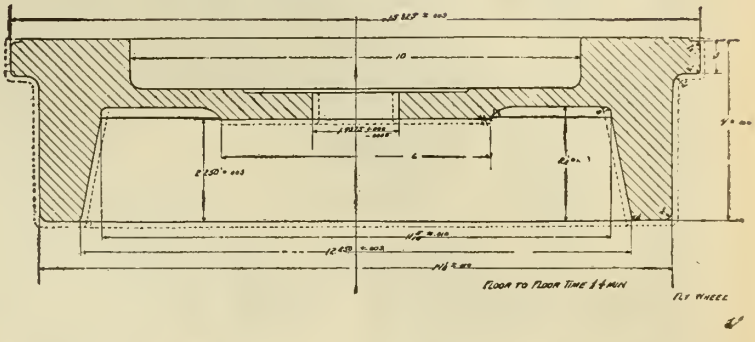
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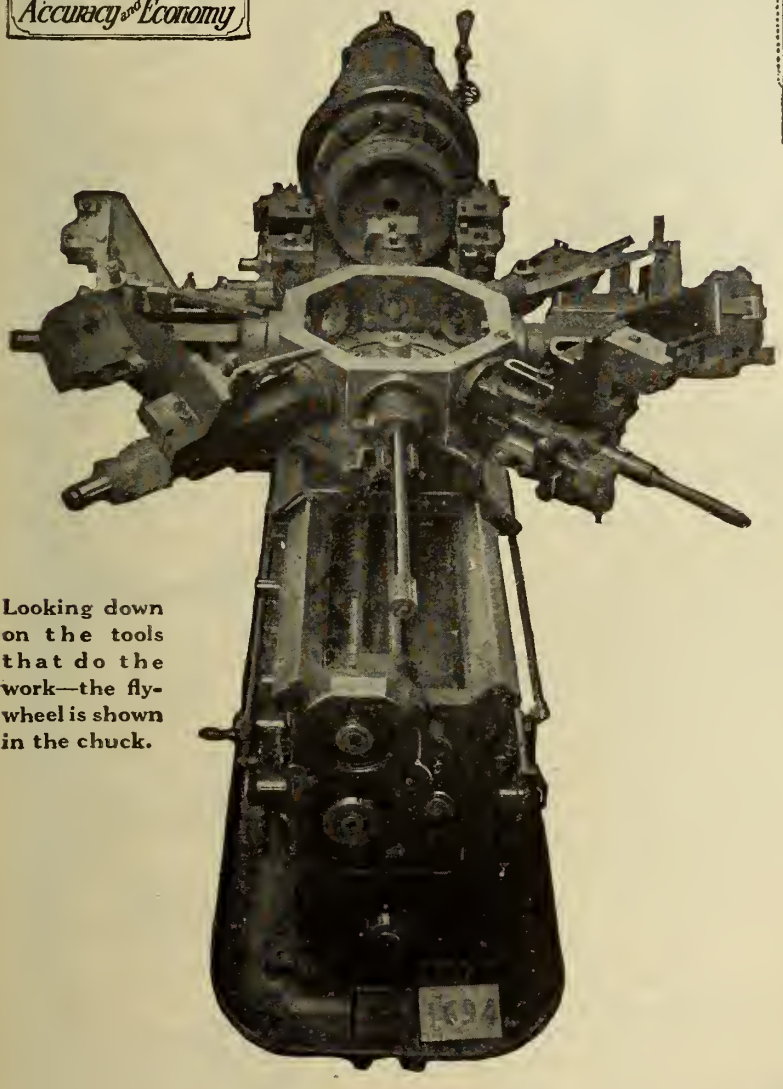
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXIV. No. 24 December 9, 1920

Efficient Automatic Machine Tool Records

An Automatic Machine Operator Should Be Provided With Suitable Charts to Enable Him to Change His Sets-ups Quickly. —Skeleton Set-ups on Turrett Chucking Lathe Are Explained.

By F. SCRIBER

TO enable automatic machinery operators to work on something better than a hit or miss plan in changing from one job to another, it is becoming more and more the practice to provide the operators with suitable charts or descriptive matter to enable them to quickly change their machines from one set-up to another, that is to say, that they can change from one class of work to a different class of work by following a sequence of set-up instructions and setting up the machine by scale measurements and also to arrange the proper feeds which will enable them to start cutting on the work set up with some degree of surety that the work being done will be very near to what is wanted and that the machine will be operating at practically maximum capacity.

An analysis of a turret chucking machine set-up which shows in some detail how this can be accomplished is the subject of this article. It is of course apparent that definite types of machines require somewhat different analysis even though they do the same class of work.

Referring to Fig. 1, we have a plan skeleton view of the actual set-up members on a turret chucking lathe; this shows a chuck A, the turret has four sides or faces B and the cross-slide carries a rear block for tools C, and a front tool block D; various dimension lines are shown in this view with dimension and indicating arrows referring thereto. The purpose of this is that with a given piece of work gripped in the chuck an operator of this machine can set his cross-slide from the chuck to a figure say 1¾ inches, as given, and can then locate his first turret face to the dimension 17 inches given. Likewise he can set the blocks on his cross-slide to the dimension 8 and 29 inches, which is shown, and then these various units will be in the correct cutting relation to the chuck for the work in hand.

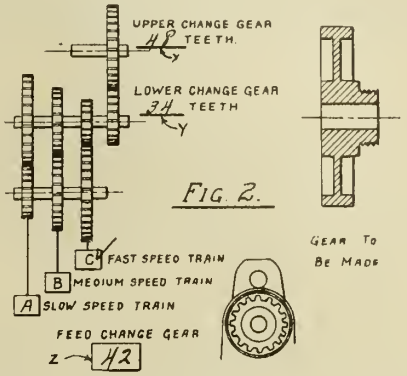


FIG. 2—SHOWING DIAGRAM OF CHANGE GEARS.

The first part of this tool-setting description refers to locating the headstock carrying the chuck with relation to the turret as in this particular type of machine the headstock is adjustable lengthwise. Reference is also made here to change gears in the following terms: "Use change gears as shown in diagram," and a diagram of these change gears mentioned is shown in Fig. 2, where it will be noted that the number of teeth in the various change gears is supplied in places provided for that purpose X and Y.

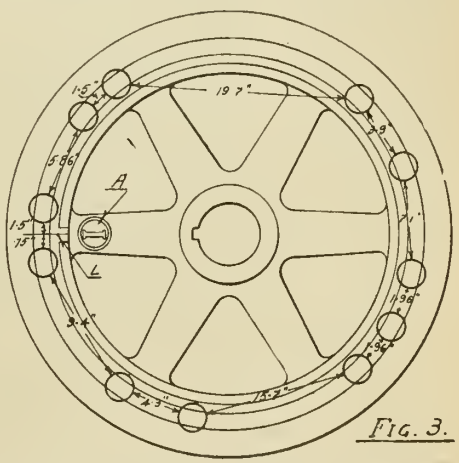


FIG. 3—ILLUSTRATING HOW THE TRIPPING DOGS CAN BE SET AT DEFINITE DISTANCES.

The train of gears to be used is indicated by a check mark, while the feed change gear Z also has to be determined for the particular job in hand. To the right of Fig. 2 is shown a special gear having a thread on it which we will assume is to be machined at this time, but before proceeding with the machining of this gear it is first necessary to set the tripping dogs for controlling the movement of the turret and the cross-slide,

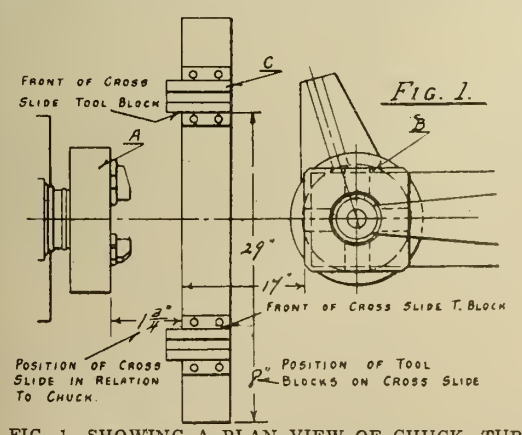


FIG. 1—SHOWING A PLAN VIEW OF CHUCK, TURRET AND CROSS SLIDE WITH NECESSARY SET-UP INSTRUCTIONS.

TOOL SETTING

To set tools, first loosen spindle headstock strap screws, thus allowing headstock to move longitudinally. With turret in forward position, bring headstock and cross slide to measurements given.

Headstock strap screws can then be tightened.

If it is necessary to revolve turret by hand, stop the turret slide at extreme return stroke. Use change gears as shown on diagram.

After this is done set the tripping dogs to suit the conditions.

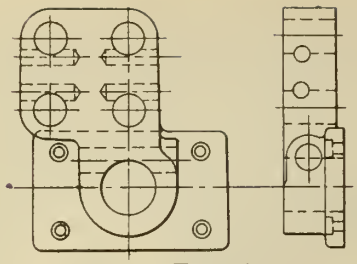


FIG. 4.

FIG. 4—ILLUSTRATING TYPE OF HOLDER DESCRIBED IN TEXT.

this being referred to in the lower portion of the tool-setting memorandum in Fig. 1.

To set these tripping dogs another diagram is provided, this diagram illustrates how, by starting at a point A the dogs may be set definite distances apart around a circle as indicated by the small circles S and F, to trip the various turrets and cross-slide operating member at the proper time. Having set the machine up as called for in these diagrams and shown by the first three illustrations we are now ready to consider the accurate setting up of the tools for machining this special threaded gear, but before proceeding with this it is perhaps better to note that a tool holder can be attached to each turret face which has in addition to the centre hole three or four other tool carrying holes, an illustration of this holder is shown in Fig. 4.

Fig. 5 shows a blank diagram suitable for use with this holder where it will be noticed that on the centre line A at the right are the words No. 1 turret face, and below this at the centre on line B, No. 2 turret face; there is a note at the top of this diagram as follows: "These numbers refer to the holes in standard tool-holder on turret," these being numbered 1, 2, 3, 4, and the purpose of these will be obvious by referring to Fig. 6.

This diagram is made for a machine having five turret faces. By referring to the gear-drawing, Fig. 2, and referring to the successive set-ups in Fig. 6, it will be noted by following the reference letters that on the first turret face A, Fig. 6, we have a spotting drill. At B we have a drill with facing cutter and two turning tools located in the holes 1 and 3 of the holder; at C we have a special boring tool in the centre hole and two turning tools in holes 1 and 3 for finish-turning the work. At D we have a reamer which is used for finishing the hole and at E is provided a threading die for threading the hub of gear, all of these tools are set up to the dimensions given from the various turret faces of the machine and are quite accurate, so they will locate the tools in the proper cutting position for finishing the gear, although it is usually necessary to take some trial cuts to obtain accurate work.

It will be apparent by following out this sequence of operations that a great saving of time will be had with much less setting up time and with less spoiled work than would be the case if the operator had to work by cutting and trying out each tool as he proceeded with his set-ups. While this plan is by no means new it is not so broadly used but what a good many variations of this general plan will readily suggest themselves.

BRASS ITCH

One of the most interesting of the occupational diseases, and one about which but little has been known as yet, is the result of brass poisoning. The matter is quite satisfactorily treated by Dr. R. P. Albaugh, in a recent issue of Modern Medicine.

The symptoms are exhibited for several hours after exposure to the fumes from molten brass or zinc. They start with a dry, parched thirst, an irritating and unproductive cough, a feeling of constriction in the chest, lassitude and anorexia—which latter is simply loss of appetite—often followed by nausea and vomiting; a headache sometimes develops and chilly sensations are noticeable within one to four hours. The chills rapidly verge into a distinct rigor which lasts from one and one-half to two or three hours. The application of warm clothing or external heat seems not to diminish the rigor of a chill. Muscular cramps and sharp pains in the joints usually accompany the chill. The symptoms end rather abruptly, almost by crisis, and are followed at once by a profuse perspiration. The patient will probably fall into a deep sleep following the stage of relaxation and without any apparent ill effects.

Brass poisoning does not occur from handling of the metal or the zinc alloys which go into its composition, but is limited to those exposed to the inhalation of the whitish smoke and sublimation products from the molten metal.

There is no specific treatment for brass poisoning, "brass itch" and "brass chills." Zinc is supposed to be responsible for the bad effects. The affection was formerly confused with malaria. Some workmen find relief in drinking hot milk to which pepper is added. A good purge also seems beneficial. Dr. Albaugh advices the prevention of brass poisoning by better hygienic arrangements in foundries and smelters, elimination of careless habits of workmen and large, roomy quarters.

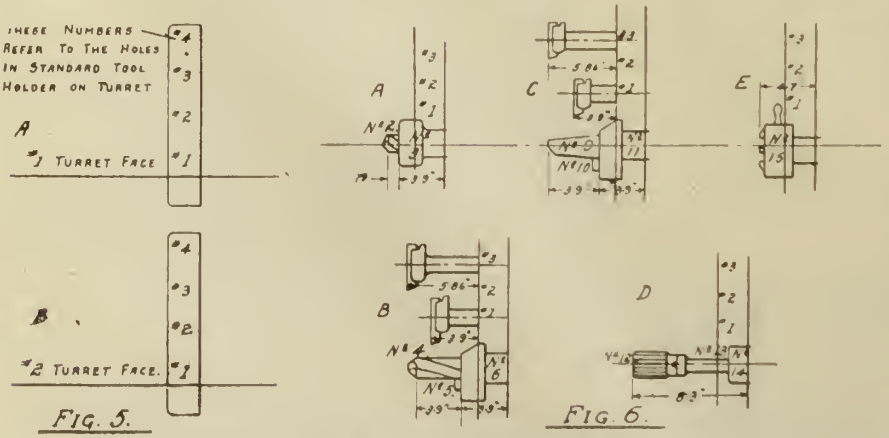


FIG. 5. FIG. 6.

FIG. 5—A BLANK DIAGRAM SUITABLE FOR USE.
FIG. 6—ILLUSTRATING THE USE OF THE DIAGRAM.

SAFETY IN THE MACHINE SHOP

In connection with its efforts to reduce the number and severity of industrial accidents, the Travelers' Insurance Company, Hartford, Conn., has recently added another book to its accident-prevention series. This new publication is entitled "Safety in the Machine Shop." It contains 188 pages, six by nine inches, and is bound in paper covers. It is a splendidly arranged book dealing with the various phases of the safety problem as encountered in machine-shop practice.

The book is divided into fourteen sections, the first of which sketches the development of the machine shop from the time such an establishment consisted of the proprietor and one or two assistants, up to the present-day shop employing thousands of persons. In the remaining sections the safety problems that arise in the modern shop are discussed in detail and careful consideration is given to cranes, lathes, automatic machines, grinding apparatus and other machine-shop equipment. In addition to the discussion of safeguarding, and safe-operating methods, subjects indirectly related to accident prevention are considered. One section treats of "Infection From Cutting Oils" and another deals with the subject of proper illumination and its bearing on the accident prevention problem.

These and other special features will undoubtedly be of interest to machine-shop proprietors and to other persons concerned in accident-prevention work. This book will be sent without charge to anyone making request for it to the supply department of this company.

Western Branch.—The Gordon MacLay building at Brandon, Man., has been purchased by the Massey-Harris Company, Ltd., at a purchase price of $130,000. A large distributing plant will be established there in the spring.

Do Machinists Correct the Mistakes of Others?

Drive Problems Are Often Misunderstood—Electricians Are Not Machinists, Therefore Should Stick to Their Own Trade—The Repair Man is the One Who Suffers.

By DONALD H. HAMPSON

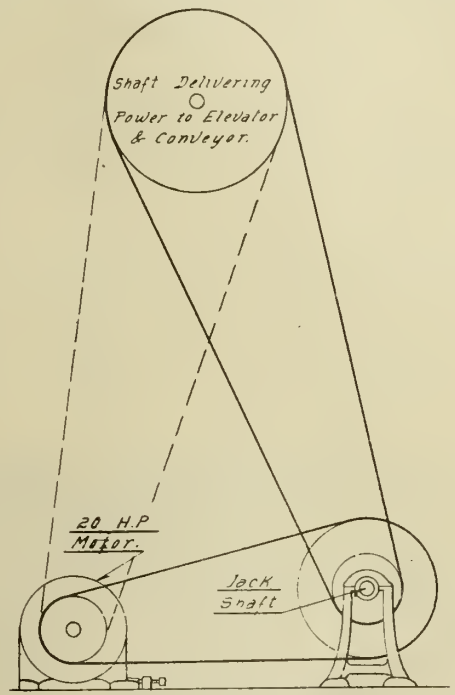
IT IS human to make mistakes; machinists make as many as any other class of workmen, while those machinists in the repair business are called upon to correct more of the mistakes of other workmen than men in any other calling. We learn more from mistakes than we do from direct instruction, probably because the thing is visualized right before us in all its glaring error. A number of mistakes innocently made by electricians will be cited.

The Gordon Coal Co. had a big elevator plant with a vertical bucket line taking coal from the track pocket and delivering it on a horizontal chute above, whence it was conducted to the proper bins for that size of coal. This machinery had been run for ten years by a 20 h.p. gas engine and had given satisfaction except for an apparent loss of power during the last couple of years. Naturally it was concluded that the engine needed a little attention—just cleaning and tuning up, for the work of unloading three cars of coal a week had been no tax upon the wearing qualities of any part. The people who had sold the engine were very indifferent in the work they did when called upon, with the result that the Gordon Co. in their inexperience came to the conclusion that the outfit was worn out.

At this juncture a couple of telephone electricians who were starting in the wiring business for themselves heard of this opportunity and induced the coal company to buy an electric motor, which the boys proceeded to instal very nicely. They placed the motor pulley in the same plane as the old engine pulley, driving with the same belt to a four-foot pulley overhead. Apparently, the item of speeds did not occur to the electricians or, if it did, they concluded that the reduction from twelve inch to the nine inch pulley on the motor was quite sufficient, not taking into consideration the fact that their motor ran at more than three times the speed of the gas engine.

When they finally got started, the belt slipped so that it would run off the motor pulley. By shortening it till it was as taut as a violin string, they made it stay on and the bucket chain began to move. It looked fine and the coal people remarked that their elevator system had more pep in it than it had shown for years. There was no coal being moved just then—due to one of the numerous schemes that are enacted to jack up the price—and the house could do nothing else than pay the bill for what looked like a good job well done.

Some weeks later when a car did get through, it was found that the conveyor could not be started with coal in the track pit. After shovelling this out and dumping in a limited amount from the car at a time, the load was successfully distributed. The electricians had been called in and they concluded that the speed was too high so they had the motor pulley reduced an inch and a half and took another piece out of the belt. The next car was unloaded in about the same manner, but not until the belt had been again shortened, and in trying to unload the car in less than five hours the pit was allowed to fill—just as in



HERE WE SEE THE CHANGES MADE TO THE DRIVE.

the old days with the gas engine. It was stove coal this time and how that chain and buckets did rasp through the pile! Six buckets ripped off and several links bent—bent so badly that they jumped the sprockets.

Machinists repaired the damage. Asked to report on the causes, they stated that the speed was entirely too high. When taking material from the side of a pile or when the material is dumped into a horizontal chute, almost any speed within reason may be employed, but when buckets must be forced in and through a compact mass at the bottom of a vertical run, the speed must be slow for commercial types of elevators to stand up at all. In this case a countershaft was interposed that reduced the surface speed from over 150 to 50 feet per minute—which is a safe maximum for such work. Better to have a mechanism which can do its work without injury and be always ready to work, better to fill each bucket every time than to bend and tear off one every time the outfit is used—this is better than a few minutes saved while the outfit is running to be followed by a protracted season of tinkering. And this is true of many things besides coal elevators.

In this case, the machinists changed the motor pulley to a size larger than the original—both to get greater adhesive surface and to lessen the bending of the belt as it passed around it, the latter being two-ply. The drawing shows the changes made. It shows also how a means was provided of taking up on the belt without cutting it every time, which had to be done when the drive was overhead. The changes proved all that could be wished. If the electricians had given thought to speed or had consulted anyone who understood this and the best practice with belts, they would have saved themselves and their customer much expense and protected the reputation they were trying to build. And this information could have been obtained gratis; workmen in one line are only too happy to help others who occasionally encounter problems in that line as a sort of side issue to their own particular field of work.

The Double Belt Fallacy

Departing for a moment from the original purpose of the article, a point in connection with the instance just recorded applies with equal force to other belt problems, i.e., the use of double belts. The motor drive named was through a double belt to the first pulley and that double belt had to form itself around that small motor pulley running at a high rate of speed.

The writer is firmly convinced that a double belt should never be used on any pulley under 18" and better not under 24", for the reason that on smaller pulleys the normal surface speeds at the inside and outside of the belt where it passes over the pulleys differ so greatly; it may be that there is a difference of 10 per cent. If the two plys were separated—not cemented together—and could be made to run that way, the difference in speed could be plainly noted, but they are not, and so the belt must stretch and slip and buckle as it curves around the pulley. What this does may be imagined. Very soon the cement bond is broken here and there and we have

two belts, somewhat stuck together, but neither of them pulling half the load as they go flip-flopping around before final separation.

To show what double belts will do on large pulleys, a certain plant put in three 8" double leather belts nineteen years ago as a means of transmitting 16 horsepower from the engine room to the machine shop. The pulleys on the shafts are all 48" and travel at a surface speed of 1800 f.p.m. To-day those same belts are transmitting 30 to 35 h.p.—they have been treated three times, the stretch taken out twice and there is no sign of a separation of plys. Contrast this with a drive the writer was asked to improve recently. The "electric light gang" had installed a motor in place of a steam engine to drive a blower in the city gas plant of the same company, the installation being a 10 h.p. motor with 8" pulley driving to a 6" pulley on the blower through a double belt. It had been a new belt, first class, and it had slipped so well that the friction had heated the inner ply, loosening it and forming it in puckering waves all around the inside. A double belt had been used because of the generally known fact that "they transmit more power and stretch less."

The writer admits to having been sold on the "more power" point of the double belt, and learned by bitter experience the falsity of it. A grinder with 6" pulleys was so equipped, and, as the belt was the best that money could buy, we concluded that the purchase of a new one every six months was a necessary expense that could not be avoided. It was not until a "drummer" (as they called them then) came along with one of the early woven cloth belts that we learned our mistake. This sample belt, at half the cost of the leather one, lasted five years—simply for the reason that it was soft enough to hug the pulley throughout the entire arc of contact and hug it so closely that it did not slip. The moral is: if you have a hard drive and the pulleys cannot be enlarged, use wider faced pulleys and a single belt in preference to narrow pulleys and a double belt. To make the point clearer by going to an extreme, just imagine how much power a pulley would deliver to a belt made of sole leather.

Returning to the subject of electricians, the boys had secured a job to motor equip the machinery in a food product plant, including the can and bottle washing machines. Somewhere they had picked up a number of 140-tooth gears which they were putting on the can washers, driving the gears through 9-tooth pinions on the motors. They went to a local shop to get the 9-tooth pinions made. The shop protested, giving their reasons as the weak teeth and the extra noise as well as a 9-tooth gear being less than standard; but they finally made the gears on a "no responsibility" basis. And in a few short months the pinions were done for, being replaced by worm drives of similar reduction. In this particular case a standard, based on theory and practice, was disregarded as a matter of little consequence—but men in every craft are apt to hold lightly the restrictions of another, so the electricians cannot be too severly censured.

The Roe Brothers firm had the only coal business in the village of Florida —progressive men who early established a coal elevating plant run by a steam engine, changing later to a gasoline engine, and finally to an electric motor as these prime movers were developed. Their motor drive was an entirely different arrangement from that of the elevator previously mentioned; in this case the motor was installed on 4 x 6 beams up near the roof, driving through two gears a length of shaft from which the bucket lines took their power. One gear, a 10-inch steel pinion of two and a half face, was on the motor shaft—it meshed with a gear on the shaft which latter was supported by hangers bolted to the same 4 x 6's. The motor was of ample size for the work. Its speed was 1200 r.p.m.

Well, any mechanic can picture in his mind what happened to that soft steel pinion delivering 15 h.p. at 1200 revolutions. The teeth were strong enough from a theoretical consideration but there was not width enough to distribute the load over an amount of surface to insure long life. The pinion wore out in three months, and not three months of steady running either. Mr. Roe brought his worn pinion in to us to make a duplicate just as quick as we could hustle it out aided by telegraph and express in getting a blank.

About three months later he came in again on a similar errand. This time our curiosity was aroused and we obtained the features of his engineering layout. The worn gears showed that the centre distances were too far apart to have the teeth mesh proper depth and our questioning brought out the point that the shafts spread apart when the load was applied, though they were close enough together under the friction load only. We guessed (aloud) that the beams sprung and that the hangers on the shaft were not rigid enough. Our suggestion was to move the motor farther away, substitute sprockets for the gears, and use a silent chain drive. The suggestion met with favor, but, of course, could not be carried out in a hurry, so we made another pinion, this to be carefully installed and the beams strengthened and the gears well lubricated.

A month later our Mr. Roe 'phoned to order the chain and sprockets at once because the new pinion was wearing and the gear also was in bad shape. Luckily the new parts came before the gears gave out altogether, and after being duly installed they ran for years and years without giving any trouble, and are running yet with entire satisfaction.

It was a case of the electricians not knowing the ill effects of high surface speed on soft gears, too narrow to wear under the most favorable conditions and in the gritty atmosphere of the place subjected to unusually rapid abrasion. Then gears at this speed should run constantly lubricated and they should be fully in mesh to insure perfect rolling contact. The substitution of the chain was the employment of a device especially designed for high speeds, long life at those speeds, and with an entire disregard for minor changes in the centres.

MORE POWER

When you have a hard drive and your pulleys cannot be enlarged, use wider faced pulleys and a single belt in preference to narrow pulleys and a double belt.

Be sure that when you install gears, the surface speed is not too high, and above all see that the centre distance are correct. If the atmosphere is dirty and gritty, decide to lubricate the gears.

Another point to remember is this: Many a drive has been improved through the substitution of a chain in place of the gears. These are a few of the lessons contained herein.

NEW LINE

The National Electro Products, Ltd., Toronto, who are at present manufacturers of electrolytic oxygen and hydrogen by an electrolytic process, have added still another line, namely that of Purox equipment. This line includes a complete range of oxy-acetylene and oxy-hydrogen welding and cutting torches, decarbonizing and lead burning outfits, gauges, regulators hose, goggles, welding rods, fluxes, etc. This is a new line in Canada but has been used in the United States for the past five or six years. The first time this line was shown in Canada was at the Toronto Exhibition, and they drew favorable comment at this time.

GIVE CREDIT

In the November 4 issue of Canadian Machinery there appeared an article on Turret Lathe Practice as adopted at the plant of the Foster Machine Co., Elkhart, Ind. In this there were drawings and portions of the reading matter which should have been credited to "Machinery," New York. We regret that at the time of publication there was omission of these credit lines to our American contemporary.

The Manufacture of High Speed Tool Steel

The Crucible and Electric Furnace Methods of Producing Steel —The Base Materials Must Be Carefully Selected to Obtain a Satisfactory Product.

THE manufacture of iron and steel is always a very interesting subject, but the story of tool steel is even more fascinating. At least such proved the case at a recent meeting of the Toronto chapter of the American Society for Steel Treating, when Mr. Cremp, metallurgist for the Canadian Atlas Crucible Steel Co., Ltd., Welland, Ont., gave an illustrated talk on "Modern Methods of Tool Steel Manufacture."

The speaker was greeted by a very large number of men interested in steel treatment in its various phases, and embellished his talk with four reels of moving pictures, the first of these showing various views of the American plant, how they weighed carefully the various ingredients, placing the material in the crucibles, the heating of same, the pouring of the metal, etc.

The second reel illustrated the electric furnace method of producing tool steel, these views showing both three-ton and six-ton furnaces in operation. Various tests were shown, also the grinding of all surface defects before hammering.

The third reel was devoted to rolling work, also depicted annealing and straightening of stock. The last reel continued on this subject and illustrated various cold drawing operations, and other interesting procedure in tool steel manufacture.

The talk was so cram full of real up-to-the-minute data that the writer decided to get the details from the speaker, so that readers of Canadian Machinery who could not personally attend might get as near as possible the full benefit of the lecture. This he was able to do, so from now on let us imagine we are sitting back in our chair, listening to Mr. Cremp.

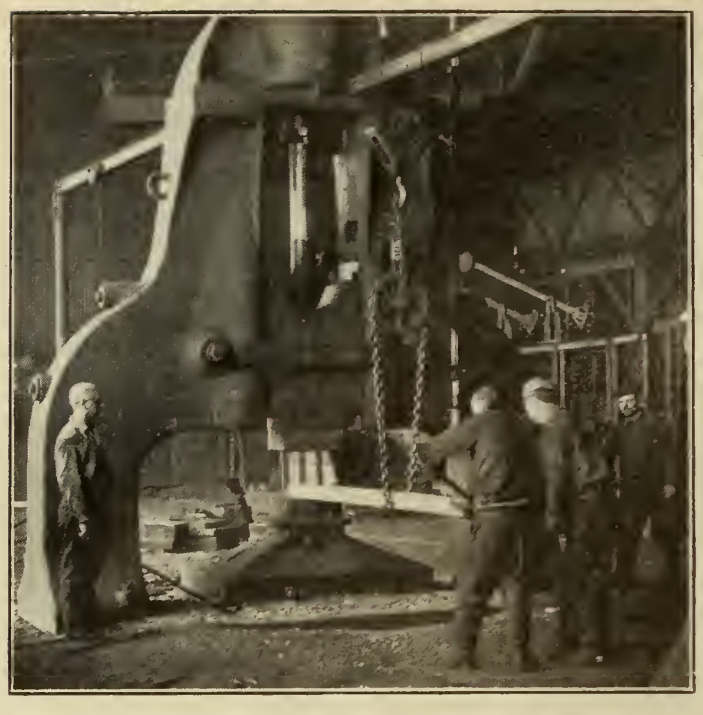
In considering the manufacture of tool steel it is very important that the process be not compared with the Bessemer or open hearth method. Those readers who are somewhat familiar with these various methods will know the great amount of hand labor necessary for a small production of tool steel. This is due to the fact that in tool steel manufacture the foremost thought has to be, or at least should be, quality rather than quantity.

It might be as well to define what I mean by tool steels, as the term is very broad. By the statement I mean all steels which are capable of being made into tools, and as such, and after suitable treatment, are capable of doing work upon other steels, metals or substances. This will include the simple carbon tool steels and all alloy tool steels. By simple carbon tool steels is meant steels which contain no elements other than silicon, manganese, phosphorus and sulphur and whose physical properties depend upon the carbon content only; the carbon content carying from 0.05% to 2.20%, depending on the use, but for most purposes between .75% and 1.35%. By alloy tool steels is meant steels which contain all of the above elements and in addition varying percentages of one or more of the following elements: tungsten, chromium, vanadium, cobalt, molybdenum, etc., in sufficient quantities to affect the physical properties of the steel.

Probably the chief requisite in any tool steel is uniformity in quality, both chemically and physically, for one must have both chemical and physical uniformity in a tool steel to obtain best results. Either may be individually perfect in a steel, yet that steel will fail when made into tools; and quite naturally it usually is the physical or structural uniformity which is overlooked. How often have all of us noted the case of two steels being identical in chemical analysis, yet one would make excellent tools while the other would fail miserably when made into the same tools? It is due to this absolute necessity of uniformity that tool steel has been limited to certain methods of manufacture for best results. In order to



A NEAT INSTALLATION OF ELECTRIC FURNACES USED BY THIS CONCERN.



THIS ILLUSTRATION DEPICTS A HEAVIER HAMMER JOB.

obtain this uniformity the method of manufacture must be capable of accurate control and for this reason the crucible and electric furnaces have met with best results and greatest approval.

As in other manufacturing processes, what are termed its raw materials are really the finished product of some other industry. So in the manufacture of tool steel few virgin materials are used, but rather the finished products of some other process. Thus are used various kinds of scrap steel, the products of the crucible, electric and open hearth steel processes; wash metal, the product of a special open hearth process; pig iron, the product of the blast furnace; melting or muck bar, the product of the puddling furnace; ferro-tungsten, ferro-chrome, ferro-vanadium, ferro-manganese, ferro-silicon, etc., all finished products of still other processes.

Selection of Base Materials

The selection of the raw or base materials is very important and only the very best are suitable for tool steel manufacture. This is especially true in the crucible process, where little or no refining can be done and the quality, that is quality as far as analysis is concerned, depends entirely upon the base materials used. As a result, all these materials are purchased on analysis, with special attention to their sulphur and phosphorus content, which two elements, as you know, are the greatest enemies in tool steel. It is, of course, true that a wider latitude of materials can be used in the electric furnace, but this should not be presumed upon. Too many have made the mistake of expecting to get first quality product from their electric furnace by using junk to begin with. This is not possible in the electric any more than in any other process of making steel, although, as above stated, the possibilities of refining are greater in the electric furnace than in any other. It is not a wise or an economical policy, for what is saved in the purchase of materials is more than offset by the extra time required to refine those materials and consequently decrease the production from the furnace.

We now arrive at the steel compounding and melting operation and will discuss the crucible process first. The various materials which constitute the base of the mix for the charge are carefully weighed out into trays. This consists of muck bar, various scraps consisting of crop-ends from ingots, billets and bars, as well as other solids of known analysis. Just so much of each different one can be used, depending upon its analysis and the result desired. The importance of care and accuracy in this step needs no comment, for, as before stated, upon the charge depends the chemical content of the product. In a separate room, technically known as the "medicine" or "dope" room, the alloys and other costly elements which largely determine the particular properties of the finished product are very carefully and accurately weighed out into metal pails. These are transported to the melting floor and there charged into the crucibles with the base materials previously described, the entire comprising what is called the "mix."

The crucibles used are manufactured from either clay or clay and plumbago, holding anywhere from 50 lbs. to 100 lbs. of material. A cap is now placed on the pots to exclude any furnace gases and is ready to be lowered into the furnace. In charging a furnace a person known as the "puller-out" (for he pulls out as well as sets-in) grasps the pot in a pair of tongs and lowers it into the hole of the furnace. The construction of the furnace is such that six pots can be placed in each hole, the total capacity of the furnace depending on the number of holes. The various sized furnaces are usually spoken of in terms of pot capacity as a twelve, twenty-four or thirty-pot furnace. These furnaces are of the regenerative type, having two sets of checker chambers underneath. The object of regenerators or checker chambers is to preheat the incoming air and gas, thus building up the temperature in the melting hole. Either producer or natural gas can be used.

In melting down the charge the direction of the incoming gas and air is reversed at regular intervals. By this reversal of direction the exhaust gases are made to flow first through one set of checkers and then through the other, giving up their heat to the brick in passing, which in turn is reabsorbed by the incoming gases. The length of time required to melt the heat varies with the nature of the mix and the elements contained therein.

Two and one-half to three and one-half hours are usually required to melt the charge thoroughly, and it is then "killed," which requires about thirty minutes. This "killing the melt" is a term which applies to that portion of the process allowed to bring the steel to the proper casting condition and to permit any gases in the molten steel to escape. This, as well as the entire melting operation, is in charge of the "melter," who must be highly trained, skillful and reliable. The exact time for pulling a crucible heat is very important and definite and must be constantly watched, as a heat having too little fire will probably contain particles of undissolved alloys, and if allowed to soak too long after melted, or if carried to too high a temperature, the pots will be badly attacked and the steel will absorb more or less carbon.

The Puller-Out

At a word from the melter, the "pullers-out" proceed to pull the white hot pots containing molten steel from the furnace. These men must necessarily be of exceptional physique, experienced and steady nerve. They prepare themselves for their work by removing all of their regular clothing and putting on special clothing, wrapping their limbs in burlap and donning "clogs," which are very heavy shoes shod with wood and iron. In order to remove a pot from the furnace it is necessary for the "puller-out" to step directly over the hole, reach down into the furnace, whose temperature is approximately 3000 deg. Fahrenheit) and grasp the pot. This is no easy task, when it is remembered they contain close to 100 pounds of metal besides their own weight; in all,

probably 120 to 140 pounds. Special tongs are used for the purpose.

As the pots are pulled from the furnace they are delivered to the melter, who in turn empties them. It is at this point that different manufacturers of crucible steel differ. Some proceed to pour the contents of each pot individually into molds whether casting small or large ingots, while others first teem all the individual crucibles into a ladle and then proceed to cast their ingots from this ladle. In my estimation there is little comparison between the two methods as far as obtaining uniformity of product is concerned. In the first method you are apt to have as many different analyses as you have pots where single pot ingots are cast, and where large ingots are cast the casting must necessarily be more or less intermittent. Outside of a few improvements in construction and handling, the entire process of crucible melting has changed but little since its first introduction by Huntsman in 1740.

Electric Furnace Method

The electric melting process is spoken of as being acid or basic, depending upon the nature of the lining in the furnace. If the furnace is operated under acid conditions, the lining is of silica brick and sand; if under basic conditions, it is lined with magnesite brick and magnesite or dolomite. Whether it is operated acid or basic depends upon the result desired. The reduction of sulphur and phosphorus and especially the latter is more easily accomplished by the basic process. As these are most objectionable to tool steel, most electric tool steel furnaces are operated on the basic principle.

In this case, instead of weighing out the raw material in 90 or 100 pound lots, the entire furnace capacity is weighed up as a charge. This charge, be what it may, ingot crop-ends, punchings, boiler plate, flashings, tubing, etc., is charged by hand into the furnace. Upon the completion of this operation a certain amount of lime and slag-making material is charged into the furnace, which is the chemically active portion of the bath and upon it depends the amount of refining that is accomplished. The entire charge is now ready to be melted down and the current is applied. The current, or "juice," as it is commonly known to the men, is usually about 100 to 110 volts, the amperage consumed depending considerably on the type of furnace and the operator using it. The usual consumption per ton of liquid steel is about 500 to 650 k.w. when starting from a cold charge. The melting down operation, that is, bringing the entire charge to a molten condition, requires from 1½ to 2½ hours.

At this point a test or preliminary sample of the bath is taken and sent to the laboratory for analysis. While awaiting the report, which takes from twenty minutes to one hour, depending on the type of steel, it is generally necessary to pull a slag. During the melting down and before the temperature of the bath becomes too high, certain impurities in the charge, and especially phosphorus, are taken up by the slag and held as long as the slag is basic. As the temperature increases and the old slag remains in contact with the bath, it has a tendency to become acid or at least less basic, so it is usually advisable to remove this slag and put on a new one.

The period which has just elapsed in the electric melting process is technically known as the oxidation period, during which the phosphorus is removed. The second period is known as the reduction period. A strongly reducing atmosphere is maintained throughout this period as well as a strongly basic slag, the object being the elimination of sulphur. The length of time necessary depends upon the degree of desulphurization required. It may even be necessary to pull one or more slags. It is also necessary, during this period (in order to hasten chemical action) to maintain a higher temperature than during the first period.

Bringing to Proper Analysis

As soon as the laboratory reports the results of the preliminary sample, the melter proceeds to make whatever additions are necessary to bring the liquid steel up to proper analysis. Here is a distinct advantage of the electric furnace in making steel; absolute control of the temperature and analysis at all times. Even if some error has been made in the original calculations or weighing up, upon receipt of the preliminary report this can be corrected. As soon as the additions have become thoroughly melted and uniformly distributed throughout the bath by frequent and sufficient rabbling, the molten metal is "killed" or deoxidized as in the crucible process. The correct pouring temperature as well as the condition of the metal is determined by pouring small test ingots or blocks. At a signal from the melter the entire furnace is tilted and its contents poured into a heated ladle. From the ladle the steel is cast into molds as in the crucible process.

The liquid steel, made by either process, is now cast into molds, which are usually square or hexagon in shape, these molds being made of cast iron. Small molds such as are used for tool steel work, say 3½ in. square, up to 12 in. or 14 in. square are usually split with a solid bottom, and when in use are fastened together with rings and wedges. The object of using split molds is the greater ease in removing the cast ingots and also greater ease in smoking the molds, which operation is neces-



GRINDING OUT THE DEFECTS. EVERY FLAW MUST COME OUT OF THE BILLETS BEFORE THEY ARE PASSED.

sary to keep the liquid steel from sticking to the sides when casting. Considerable care must be exercised on the part of the molder in preparing and setting up the molds to see that they are properly aligned and plumb. If they are not exactly perpendicular the metal, when flowing from the ladle into the mold will stick on the sides or splash, producing rough and bad ingots.

The ladles are usually of such capacity as to hold the entire heat, and consist of a metal shell which is lined with fire-brick. In the bottom of the ladle is a hole into which a clay or graphite nozzle is fitted, the size of which varies with the size of the ingots being cast. This nozzle, through which the liquid steel flows, is opened and closed by means of a rod on the bottom. The stopper, as the entire rod and stopper is called, is actuated by means of a handle hinged on the outside of the ladle.



AN EXAMPLE OF LIGHT HAMMER WORK.

Obtaining perfect cast ingots is of the utmost importance to the tool-steel maker, and is his first great source of difficulty. I mean by perfect ingots, ingots which are free from pipe, segregation, blow holes, fins, rough surfaces, and a hundred other objectionable imperfections which render the ingot wholly or partially useless. It is a well known fact that in order to obtain good finished material, it is absolutely necessary to start with good ingots. Piping is one of the greatest, and certainly the most noticeable difficulty encountered in the ingot. Pipe is the term which is applied to designate the shrink cavity which forms in the ingot as it solidifies.

Annealing the Ingots

As soon as the ingots have cooled sufficiently so that when tipped over they do not bleed, the rings are knocked down and the ingots stripped. They are then transported to the annealing department. Not all ingots are annealed before working, but high-speed and certain other alloy steel ingots should be. After the ingots are loaded into the furnace they are slowly brought up to the annealing heat and then allowed to soak at this temperature. The operation is not so much to obtain a soft ingot, although an annealed ingot will work softer than one which has not been annealed, as it is to remove the cooling strains of the ingot and to allow the internal structure to rearrange itself. After they have soaked a sufficient length of time the firing of the furnace is stopped, and the furnace and ingots are allowed to slowly cool. When they reach a temperature below a black the ingots are pulled out and passed on to the first inspection and grinding department. The entire annealing operation requires about twenty-four hours.

The inspectors carefully go over each individual ingot and mark with crayon any seams, cracks, or surface imperfections which might develop into larger imperfections in the billet. The grinder operator now takes the ingots and painstakingly grinds out all places marked by inspector. This is an expensive, and to many, an unnecessary operation, but experience has shown that with certain types of steel, too much care and caution cannot be exercised, as surface defects never grow smaller but always work larger in subsequent operations.

Chemical Analysis

It is at this point in the progress of the ingot that drillings are taken from every heat of ingots and sent to the laboratory for complete chemical analysis. The laboratory must be in charge of an experienced and reliable chemist whose only duty is to report accurately every element determined. A complete report of every heat of ingots is made, and if the content of each element does not come within certain specifications the heat is scrapped immediately. The specifications for different grades, of course, vary with the use for which they are intended, but in each case must be rigidly adhered to. It is also important and absolutely necessary in order to avoid error that no material should be applied on orders until a complete analysis of the heat is at hand. It is the frequent case in many mills that certain ingots are applied on orders on expected or hoped-for analysis, but this is poor policy as too often your hopes are wide of the mark.

The analysis being approved, the annealed and ground ingots are now ready for the cogging hammers and are transported to that department where they are charged into the reheating hammer furnaces. The firing is started, and the bringing up to forging temperature is carefully and slowly accomplished. With each hammer is the hammer crew, consisting of hammer, man and helper, hammer-driver and lever men, in each case named after the duty performed. The hammerman is in charge of the gang and is responsible for the work done, frequently working on a contract tonnage basis and hiring his own men. He must be a man of experience and know exactly how high to heat each different grade of steel, within what limits of temperature each grade of steel will forge without disaster, and just how much reduction they will stand. The size of the ingots must be properly proportioned to the different sized hammers, or correct results cannot be obtained. Overheating and bursting are two of the greatest difficulties encountered in this department.

The average hammers used in tool steel mills range in size from 1,000 pounds to 12,000 pounds and are steam driven. Steam and hydraulic presses have been experimented with on tool steel to a considerable extent, but in general have not met with best success, the action being rather more drastic than most tool steels will stand and especially high alloy tool steels. When the ingot has reached the correct temperature, which is measured by a pyrometer, it is taken out of the furnace, placed under the hammer and reduced to what is known as a billet. A certain amount of the pipe end of the ingot is cropped off at this stage, depending upon the soundness of the ingot. This is known as the crop end and will amount to 10 to 20 per cent. of the ingot weight. Another appreciable yet frequently overlooked loss starts to assert itself with the heating operations on the ingots and billets. This is the loss due to scaling. Few would believe that this loss alone amounts to 10 to 20 per cent. of the weight of the ingot. Neither of these are total losses by any means as both are kept separate according to the grade

of steel and returned to the melting department where they are remelted and start their journey over again. The amount of reduction varies with the result desired, but usually runs about 65 to 80 per cent. in area. This entire operation is called cogging. In fact, every operation of reduction, whether on the hammers or rolling mill which does not produce the finished size is called a cogging or recogging operation.

The cogging or forging operations have more for their object than the mere reduction to the size and shape. The steel as it exists in the ingot is in a very unrefined and coarse crystalline condition, with the carbon content and other elements more or less segregated according to their solidification temperatures. The forging operation tends to uniformly distribute the various carbide segregations by breaking up the large, weak crystals of formation and producing a refined, uniform structure throughout. In order to accomplish this objective it is necessary that sufficient work be put upon the ingot and at a proper temperature.

The billets are once more taken to the inspection and grinding department, and if of a type of steel which makes it advisable, they are annealed. The inspecting and grinding of the billets is carried on in exactly the same manner as described for ingots. There are certain types of steel which can be chipped with air chisels. On this material it is easier to chip the imperfections out than it is to grind them.

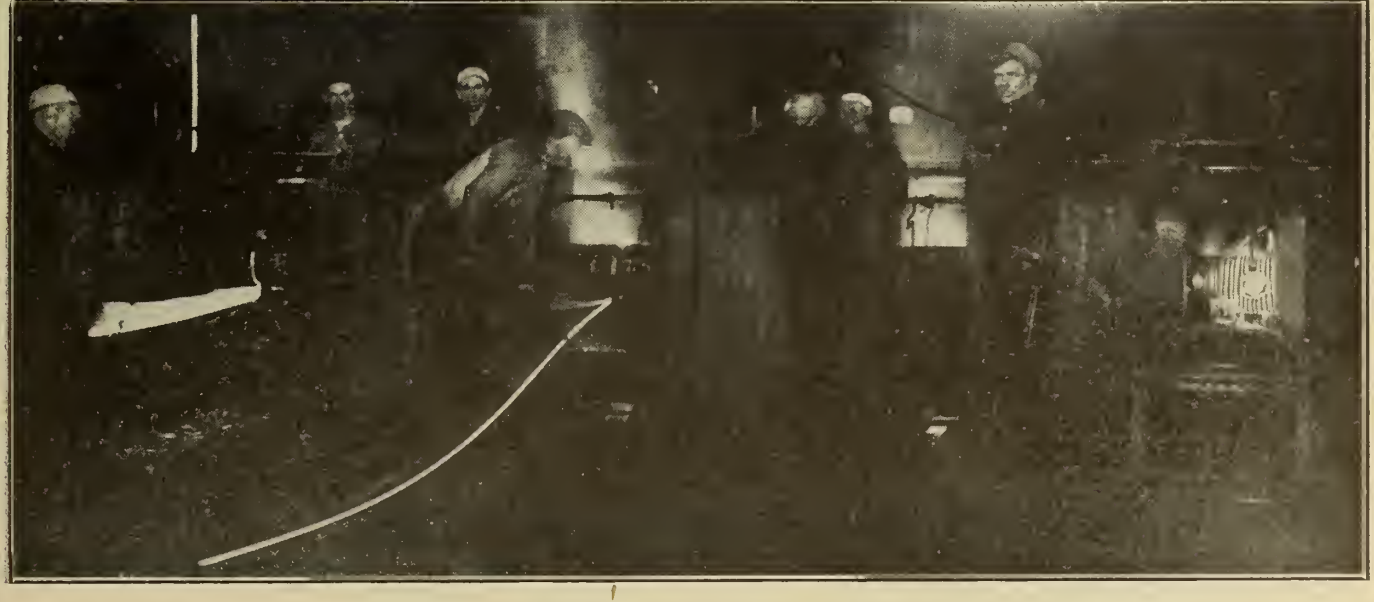
Rolling

The ground and inspected billets are now delivered to either the hammers or the rolling mills as the case may be for recogging or for finishing. The recogging would be carried out just as previously described in the cogging operation. If the work is such that it can be done on the mill, it is advisable to do so as their work is much quicker and more accurate. On a mill the reduction and working is brought about by passing the billet back and forth through grooves in rolls. Each succeeding groove is slightly smaller than the one previous, and in this way the billet continually decreases in cross section and increases in length. The shape and succession of the different grooves for efficient rolling is a unique science in itself and must be laid out so that the material is not burst, seamed, lapped, or scratched in any way. A mill is always designated according to the diameter of its rolls as a 10 in. mill, a 14 in. mill, these meaning a mill having 10 and 14 in. rolls respectively. Most mills are built with rolls three high and driven in such a manner that the material is fed through one way between the bottom two rolls and back through the top rolls. The length of a train of rolls is spoken of in so many stands as five, six, or seven stands. The different sets of rolls which make up the stands are known as roughing rolls, strand, leader and finishing rolls, according to the shape of the grooves in them and the duty performed. The mill forms a very efficient and rapid means of working steel and has many advantages over a hammer but must be in the hands of a competent roller to produce the results desired.

Great care must be exercised in setting up the mill to get everything in alignment and have the work pass through smoothly. Not only rounds, but squares, hexagons, octagons, flats and many remarkable shapes can be rolled on a mill, one of the principal advantages being that once the mill is set up and the size and shape found to be correct, any amount of material can be put through, and it will all be exactly alike. The greatest difficulty encountered is the time lost in changing rolls to meet the different sizes and shapes. Consequently it is advisable to segregate all the rounds, squares, and flats and roll them at once while the mill is set up. This partly accounts for the reason why sometimes when an order is placed with a mill the delivery seems unreasonably long, while at other times most extraordinarily short, all depending on whether the order arrived just after or just previous to a rolling of that size and shape.

The ingot has now arrived in its finished shape and size and is known as a hot rolled or hammered bar, but is still in a condition not suitable for most uses. The bar is still in a raw condition, ununiform and quite hard; structurally it is in a sorbito-pearlitic condition. In order to put it into a usable condition it must be annealed; acordingly, the raw hot-rolled bars next go to the annealing room. Here they are packed into tubes with some material such as charcoal and ashes, lime, sand, etc., and the ends of the tubes sealed with fire-clay. Some manufacturers do not pack their material for annealing but its use seems very desirable and beneficial. First, it causes the heating to be slower; second, it tends to a more uniform condition throughout the entire bar, and third, it causes the cooling down of the bars from their annealing temperature to the slower, all of which are essential to good annealing.

The sealed tubes and their contents are now rolled into the furnaces, which are then sand sealed and the heat applied. The annealing temperatures are all carefully predetermined and controlled by pyrometers. The particular annealing temperature in each case depends upon the type of steel being annealed. The time of heating, time held at temperature and cooling must all be correctly worked out and varied according to the size and kind of bars. The usual annealing operation requires about twenty-four hours, and it is usually considered best practice to allow the tubes



ROLLING OUT THE BARS. THIS, OF COURSE, IS ON SMALLER SIZED STOCK.

and material to cool down below a black before removing from the furnace. The annealing operation not only softens the steel but it also puts it in a uniform and stable condition.

Final Inspection

The annealed bars are now removed from the tubes and go into the final inspection department. Here each individual bar is carefully gone over for size and surface conditions, a portion from each end is broken off so that the condition of the grain can be examined. From this examination can be learned whether or not the annealing has been correct, whether the bars have been decarburized in the mill or in the annealing, and whether the bars have any minute pipes or other internal imperfections. The man doing this inspection work becomes highly skilled and can pick out small pipes and imperfections which the ordinary person could not see. Here also several ends from every different lot of bars from each heat are taken and tested for hardness. By far the best method in my opinion for making this test is the Brinell, the principle of which is well known. Certain limits of hardness are established for the different grades and tempers of steel, and unless the tests come within these limits the material is rejected and reannealed. After the bars have passed this final inspection they are sawed, straightened, stamped, and bundled ready for shipment.

Due to the many different grades of steel, different shapes, and the thousands of different sizes, a very accurate yet simple system of keeping track of the material from the ingot to the finished bar must be worked out. Not infrequently a billet or two of one kind of steel gets into a lot of billets of the same size of another steel and probably will not be caught until the final inspection and sometimes not here if the only difference is in the temper, both being the same grade. Consequently, the entire process requires constant vigilance and attention in order to produce quality material, which every tool steel manufacturer should desire. By far the greatest part of the task of maintaining the quality of the product falls to the metallurgist as most everyone else is primarily interested in the production and are very apt to overlook many vital matters to accomplish that end.

He usually has at his disposal a well-equipped physical or metallurgical laboratory and capable assistants. I wish to particularly emphasize the vital importance and usefulness of the work which is capable of being done in this department. In the past it has been frequently the case that the physical laboratory has been more of a show place, or at best an experimental department, but in the present day demand for uniformity and quality in tool steel this department becomes a prime factor. One of his most useful friends in this work is the microscope. By the proper application of this apparatus he is able to control the internal structure of his product and is able to tell when things are not going right, and by making frequent observations of the ingots, billets and finished product he is able to keep the entire material lined up on a good basis.

FORM TOOL MAKING

By J. Homewood

WHEN rapid production of intricate formed faces on brass products is desired, at the same time maintaining uniformity of shape and size, the following adapter and attachments for an engine lathe are recommended. The material produced from a turret lathe will be rapidly made, and with form tools such as I describe, will enable inexperienced operators to produce accurate work in rapid time.

The form tool shown in Fig. 1 will obviously have to be held in an offset tool holder on the turret lathe; one that can be adjusted for center distance to suit the size of work to be produced. Inasmuch as the product in this particular case is of brass, the form tool will be made out of carbon steel, preferably a nonshrinking and nonchanging steel such as Ketos, or any other steel on the market with the necessary properties. If it is impossible to secure steel of this class, extra caution should be exercised in hardening owing to the shape of the form tool, as the contractions taking place in a tool of this type when same is hardened will very often result in a crack or a total break.

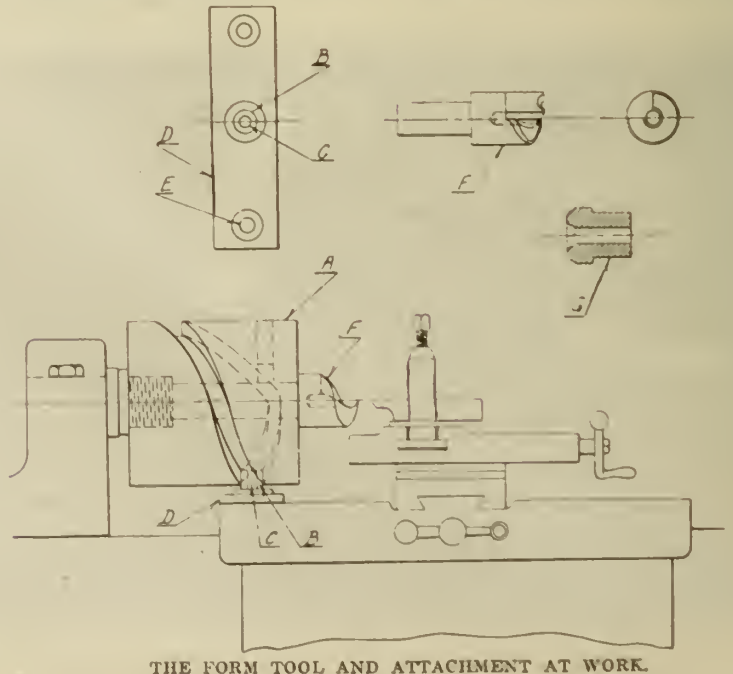
The writer has had considerable experience with this type of form tool and after considerable grief in the way of broken tools finally resorted to the following method of hardening, where ordinary carbon tool steel was used, which proved successful in almost every instance. Heat the tool up to as low a heat as it will harden under, then dip it in warm salt water until the vibrations can no longer be felt in the tongs; after which put the tool in oil.

The form tool is first turned up in the lathe and faced square on the working end. A hole is drilled in the center, as shown so as to provide clearance for the cutting tool. One-quarter of the tool is cut away in the miller so as to provide room for the master tool to back out of the way. After the blank is milled out, it is put into the cam chuck adapter and secured from turning by a set screw. The cam is screwed on the spindle of the lathe, and this cam operates the carriage back and forth by means of the roller (b) which rides on a shouldered stud (c). This stud is fastened in the center of a strap that spans the lathe carriage and is fastened thereto by cap screws.

The compound rest is set parallel with the ways so that it can be used for feeding longitudinally. A lathe on which the rack and pinion can be disengage is most suitable for this class of work so that no drag will be put upon the carriage. It is sometimes found advisable to have a tension of some kind taking the slack out of the carriage and roller engaging with the cam. The rise of the cam is enough to give cutting clearance on the forming tool.

A committee is now discussing ways and means for the proposed new county hospital to be built at Simcoe, Ont.

The erection of a fourteen-storey building at the corner of Bay and Temperance Streets, Toronto, is being planned by the York County Athletic Club. The plans are well under way, and the estimated cost is $2,811,000.



THE FORM TOOL AND ATTACHMENT AT WORK.

Would You Like to Receive One of These Scales FREE?

You can easily do so and at the same time add to your store of knowledge by entering our weekly contest of which details are given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

The Lucky Prize Winner for Nov. 11th Issue List is FRANK WALSH, 93 S. Bentruck St., Sydney, N.S. He Had All Answers Correct.

CONTEST FOR DEC. 9TH ISSUE

Contestants are required to write us, stating to which advertisements we refer to in this number.

1. Something that has four heads. Oh, no—it's not a man. What is it?
2. Something that has been accumulating for over sixty years.
3. How to secure prompt shipment of a certain product which is made in all standard sizes.
4. How to overcome the present power shortage.
5. Something that is at your beck and call.
6. How to keep track of every heat treating operation.
7. How to produce exact work in record time.
8. A company that produces a product in Canada different from anyone else.
9. Something that your lips never touch.
10. A product that will withstand heavy pressure without increasing its temperature.
11. A machine that can cut pieces up to 120 inches diameter.
12. How to secure the reward of greater production.

These are Correct Answers for List from Nov. 11th Issue:

1. H. W. Petrie Co.
2. The National Acme Co.
3. L. S. Starrett Co.
4. Bilton Machine Tool Co., and Fisher Motor Co.
5. A. B. Jardine Co.
6. Union Mfg. Co.
7. Clipper Belt Lacer Co.
8. R. McDougall Co., Ltd.
9. Holden Co., Ltd.
10. Norton Co. of Canada.
11. Canadian Machinery advertisement.
12. Canadian Driver-Harris Co.
13. Brown & Sharpe Mfg. Co.
14. Clemson Bros., Inc.

Closing Date for This Contest is December 30th



WHAT OUR READERS THINK AND DO



John Conley Gets Some Planer Experience

Planing Thin Work, Curves, Locomotive Links, Irregular Shapes, and Spirals, are a Few of the Problems.

By J. DAVIES

JOHN has found out, that to "pack all your troubles in your old kit bag" is not the way to get them solved, not in a machine shop anyway. He prefers to share them with the other fellow, so that when he had a thin plate to plane all over on both sides, and found that it was too big for the vise and he couldn't put plates on the top because he had to plane the entire surface, he simply made tracks for Tom Clark, an old planer hand, and asked him for advice.

Tom came over to John's machine and examined the job critically and then said, "I should advise you to hold it down with toe dogs and use the Johnny blocks to get the size." "Quit your fooling, what's a toe dog and a Johnny block?" "In a job like the one you have, there is only two ways to fasten it down that I know of. If the plate is thick enough and holes in the sides of the plate are no detriment to the job, we generally drill holes and use what we call finger clamps, some call them toe clamps."

When it is undesirable to drill holes in the work, toe dogs are usually resorted to. This equipment consists of pieces of wrought iron or steel made to fit the slots of the table, with a hole drilled and tapped at a slight angle to receive a set screw. Pieces of steel of a suitable length are ground, one end with a ball point to fit the cupped end of the set screws, the other with either a chisel or centre punch end to press against the work. Care must be taken that the angle of the toe dog is not too great—the angle of the tapped hole is usually 8 or 10 deg., just enough to insure that the dog will press the work hard down to the table. When using toe dogs, stop pins must be used to prevent the work slipping on the table."

"I understand you now, but what about the Johnny blocks?"

"Johnny blocks is a shop term for Johanson precision blocks. They are simply blocks of steel, hardened and ground very accurate and can be built up to any size. They are very useful to get your sizes on the planer."

"How do you use them?"

"How thick is this plate to be finished?"

"Three-quarters of an inch."

"Well, simply get a block that is ¾-inch. thick, place it on the table and set your tool to just touch it or to pinch the thinnest piece of paper you can get, or if you have a job with a number of sizes get the blocks to correspond to the different heights and set your tool or tools to suit the blocks. I find them very useful and accurate.

"I will have to go though, for my cut is nearly over, still there are one or two other things you want to look out for. When you lower your cross rail, lower it as close to your work as you can and if you have an important job on, test if it is parallel to your table with the indicator. Put your tool in straight so that if it should happen to move it will swing away from your work and not dig into it."

"Thanks very much, perhaps I may be able to do something for you some day."

"Oh, that's nothing, if you are interested come round to my place some evening and I will tell you of some of the unusual planer jobs I have seen."

"Righto, how would next Monday night suit you?" "It suits me all right." "All right, I'll be right there."

Some Interesting Tales

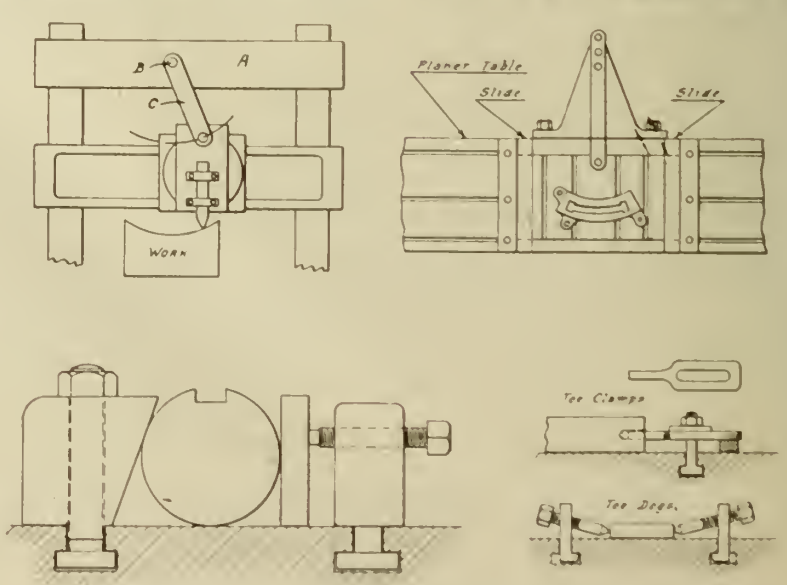
On the following Monday evening John duly presented himself at the home of Tom Clark and found him deeply engrossed in the pages of Canadian Machinery. Although Tom was a regular old timer he kept himself informed of all the latest developments of the trade and could relate some interesting experiences. When they were comfortably settled down John said, "Now, Tom, what do you consider your most interesting planer experience?"

"I don't know, but probably planing some taper radial sections for a swing bridge." "Do you mean to tell me you can plane a radius or a curve? I thought a planer was for straight work only."

"Sure thing, you can do all kinds of things on a planer if you have the attachments. When I was working at the Canada Foundry they planed all the links for the Canadian Northern locomotive that they were building."

"How did they do it?"

"In planing links such as are used for locomotives, the tool is stationary except for the downward feed, and the



SOME LESSONS ON PLANING CAN BE LEARNED FROM THESE SKETCHES.

work is made to travel through a curved path. This is accomplished in several ways. The most satisfactory is where the work is bolted to an extra table held between strips, which hold it from moving lengthwise on the table, but allow it to travel transversely across the table. Attached to this extra table is a bar with a hole in it the required radius. Through this hole passes a pivot pin, which is fastened to some secure support. If it is a very large radius which requires but a very slight cross motion of the extra table and necessarily a very long arm, the support for this pin would probably be on a special concrete foundation of its own. If the radius is a very small one and the pivot pin must be close up to the planer table, it can be very conveniently supported by a bracket bolted to the side of the planer.

"As the table moves backwards and forwards, the extra plate to which the work is fastened rotates about the centre of the pivot pin, and in so doing slides backwards and forwards across the table. Where frequent variations in radius occur, the link may be slotted and the pivot pin adjusted to different radii, as shown in sketch."

"Another radius planing job is to plane a casting to sit on a boiler, where the curve would have to be the same radius as the boiler. This is a little different from the link planing attachment. In the link planing attachment the work was made to swing to a given radius. In this attachment the tool is made to swing in a given arc. If the construction of the planer is such that it is not convenient to bolt your attachments to the housing direct, a bracket A is bolted across the housing B, and carries an arm C.

"One end of the arm C swings on a pin attached to A and the other end is pivoted to the tool slide. The feed screw is removed, which allows it to slide up and down freely. After the work and the tool are properly set the planing is done by simply feeding the saddle along the cross rail. The horizontal movement causes the tool point to follow a radius equal to the length of arm C, which is made to suit the required radius. This type of attachment can only be used when it is a true radius that is required."

"Does that mean that it is only possible to plane to a true curve?" "Oh, no, not by any means. By making a template the shape required, an irregular form, convex and concave, can be produced. The template is bolted to the cross rail by any convenient attachment, this, of course, would depend upon the construction of the machine.

"The template is made with a slot in it and a roller that is attached to the tool slide is made to fit this slot when the saddle is fed horizontally along the cross rail, the tool slide moves up and down and conforms to the shape of the template, thus producing the shape of the template on the work."

A Planer's Varied Uses

"Isn't it surprising the variety of work that can be done on a planer?" "I should say so, why in a case of emergency I have seen them cut gears on a planer." "How were they set up?"

"The gears were put on a mandril and a bracket containing centres was bolted to the planer table, and a gear, a small gear would do if it had the same number of teeth, put on the same mandril. A spring finger was made to fit the space in the index gear and bolted to the table so that the number of teeth could be correctly spaced." "Wouldn't it be handier to do all those kind of jobs on the miller?"

"Generally speaking, yes, but occasionally the planer is the best. I remember a case in point, the Elliott paper box factory wanted some corrugated rolls made, such as they use for making corrugated paper. The planer was the only machine long enough to do the job so the superintendent fitted up a milling cutter with a suitable bracket to the cross rail and devised a special slow forward feed with a worm and worm wheel arrangement. This could be thrown out of gear with a lever and the table run back at its ordinary speed at the end of every tool. The roll was about 64 inches long.

"Another interesting planing attachment is used at Grey's in Toronto. They not only make corrugated rolls for flour mills there, but special corrugations too. In cutting spirals, a clamp is fastened to the work with the end extending across the table. The end of this clamp travels up and down an inclined plane that is fastened to the housing of the planer and is kept in contact with it by a suitable weight. As the table travels backwards and forwards, on account of the inclined position of the piece bolted to the housing, it forces the work to make a partial revolution with each stroke of the planer. By varying the angle of this bar the amount of travel on the work can be regulated. The steeper the angle formed, the steeper will be the pitch of the spiral. The planing is done with a tool formed to the desired shape. The right number of spirals can be obtained by a ratchet wheel arrangement which can be made to move any number of teeth each stroke of the table.

"Another very useful attachment for a planer is a pair of vee blocks, and by the way, the planing of a pair of vee blocks involves a principle that may be very useful to you. First plane a tongue on the base of the two blocks to fit one of the slots in the table, fasten the two blocks in position, set over the head to 45 deg. and take a cut off. Then without moving the angle of the head or position of the tool, turn the blocks round and take a cut off the other side. This ensures that they will be both alike, equal angles, and will be in line at any part of the table. Round stock is also held by means of a special planer strip. This strip has a tongue on the base to keep it in a line and it has an angular face so that the pressure on the shaft forces it down upon the table, but enough for one night."

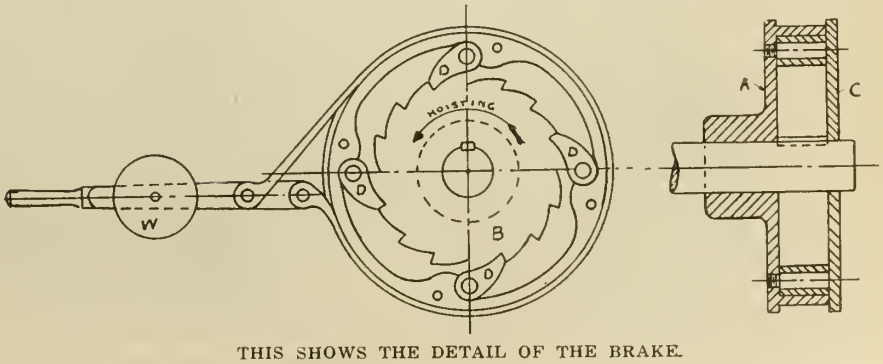
In a communication by the Director of Mines, U.S.A., to the "Journal" of the Franklin Institute, it is recommended that carbon tetrachloride fire extinguishers should not be used on fires in confined spaces by persons who are not protected from the gases arising or who are unable to escape from the immediate vicinity of the fire at once after applying the extinguisher. The following gases, it is stated, are generated when carbon tetrachloride liquids are vaporized: Phosgene, one of the most poisonous gases used in warfare, chlorine and hydrogen chloride. The vapor of carbon tetrachloride itself is a dangerous anaesthetic. It is only in confined spaces, however, that dangerous concentrations of these gases are produced.

EFFICIENT BAND BRAKE

By G. Wilson

The accompanying sketch illustrates a band brake that can be used for a great variety of purposes. The principle of the brake can be readily seen. The main casting A carries the pawls D and is free to move on the shaft. When hoisting, the racket wheel B is revolving only.

To release the weight, W has to be lifted; C is merely a cover plate fastened to the main casting by small screws.



THIS SHOWS THE DETAIL OF THE BRAKE.



DEVELOPMENTS IN SHOP EQUIPMENT



POWER PRESS BROACH

The Hercules Machinery Co., Detroit, Mich., have placed on the market a power press broach which is illustrated herein.

The working elements consist of a ram to which motion is transmitted by means of gearing which is controlled by a single lever through a system of friction clutches. The ram is a high grade steel rack, cut 4-5 pitch, and ground perfectly true with removable hardened steel head, and key-seated the full length, insuring perfect alignment. All gears are cut stub tooth, 20 degree pressure angle. This press broach is exceedingly simple, sturdy, powerful and convenient, and does by power a large variety of operations requiring pressure, such as forcing arbors, bushings, shafts or pins in or out of holes, seats into valves, linings into pumps, etc., straightening or bending, forming, sizing holes with hardened plugs, testing castings, sealing valves for testing, expanding babbitt bearings, etc.

It is an efficient tool for all broaching operations, and is designed for rapid quantity production, and can be conveniently placed for different operations on any assembling conveyor line. The knee can be removed and replaced with other fixtures that might be required for different draw or push broaching or other operations. The three speeds of the Hercules power press broach are all handled with the movement of one lever. By the upward movement of the lever the "quick-return" speed is obtained. By the inward movement of the lever the "fast down" speed is operated, while the downward movement of the lever gives the slow or pressure-down speed. The hand wheel is for use only when setting up some operation requiring close adjustment. An automatic throw-out also forms a part of this outfit, and this throw-out has the same effect as the automatic stop on a screw machine and permits the operator to set and govern the travel of the ram. The knee of this press is carefully fitted to perfectly machined ways with a shear pin support, making it impossible to overload and thereby avoiding all breakage. Not only is the shear pin a safety factor, but in the event of extreme overload the clutches would slip before breakage could occur.

BENCH DRILLING STAND

The Black & Decker Mfg. Co., Baltimore, Md., has placed on the market a bench drilling stand as illustrated. It can take from ⅜-inch to ⅞-inch portable electric drills of this company's design, and they can be quickly detached when desired.

The bracket carrying the drill can be raised or lowered on vertical column and is secured in any desired position by means of split collar and clamping screw. Drill may be swung clear of base, making it possible to use this stand for such work as applying ring gears to automobile axles, drilling in the ends of shafts, and other work too high to be drilled on the bench. Both vertical and horizontal adjustment are secured by means of the clamping screw.

Extra long feed lever gives feed ratio of 6 to 1. 100 pounds pressure applied to handle feeds drill under 600 pounds pressure. In the base are six tapped holes to accommodate half-inch studs, used to clamp work in place. One stud with nut and clamp is supplied with stand. This bench drilling stand is said to be exceptionally rigid, all parts being of unusually generous size. For instance, the vertical column is a solid steel shaft 1 7-16 inches in diameter. Base is provided with four holes for fastening stand to bench. Four ⅜-inch lag screws are supplied.

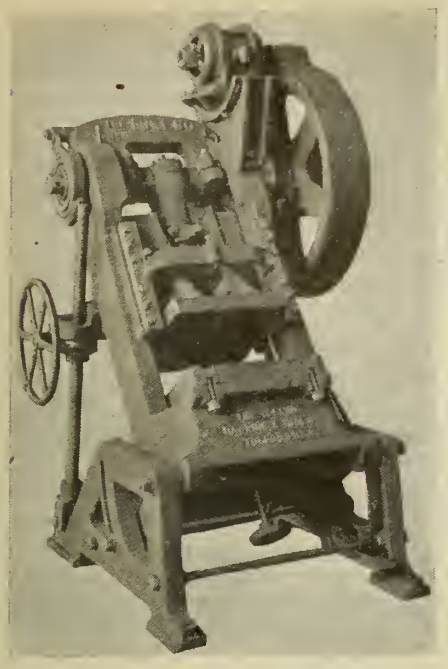
Following are some interesting dimensions: Height (bottom of base to top of vertical column) 30 inches, vertical adjustment of drill 12 inches, drilling radius (distance from centre of drill bit to circumference of vertical column), 7 inches, horizontal adjustment of drill 360 degrees, feed (vertical travel of drill when operated by feed lever) 4 inches.

INCLINABLE PRESS

The Toledo Machine & Tool Co., Toledo, Ohio, have placed on the market a straight column press that possesses several unique features. Reference to the photograph will show that this press may be used in either an upright or inclined position by simply turning the hand wheel. It is also entirely self-contained, being driven by a direct connected electric motor. Attention is called to the



VIEW TO LEFT DEPICTS POWER PRESS BROACH. THE ILLUSTRATION TO RIGHT SHOWS BENCH DRILLING STAND.



GENERAL VIEW OF THE PRESS.

motor bracket which is so arranged that it always keeps the motor in a vertical or upright position no matter whether the press is upright or inclined to any angle within its limits. The pinion is always in mesh.

The distance between the uprights is somewhat greater than is ordinarily furnished on a press of this size. The slide is of liberal proportions and is carefully guided in substantial gibs, to insure the greatest possible accuracy.

The makers state that this machine can be furnished with or without gearing and with or without the bar knockout in slide and the direct connected lower lift-out, as well as with or without the motor bracket. It is also built with the frame arched out from front to back and with an opening 14 inches wide in each housing to permit of feeding the stock from right to left or vice versa. Following are its principal specifications:

Weight as shown, 6,500 lbs. Bed, 24 x 23 inches, Bottom of ram, 21 x 19½ inches. Opening in bed, 12 x 12 inches. Distance between housings, 24 inches. Stroke, 2 inches. Distance from bed to ram, stroke down and adjustment up, 13 inches. Thickness of bolster, 3 inches.

ELECTRIC GENERATING APPARATUS

The Dodge Manufacturing Co., Mishewaka, Ind., have placed on the market an electric generating apparatus that is of rather interesting design. The photograph herewith shows clearly its general construction, and this outfit consists of complete power units for electric generating. Tests have been made on these units in strict accordance with the rules adopted by the American Institute of Electrical Engineers.

The generating units are made up either direct connected or belted in all standard voltages using Dodge heavy oil engines as motive power. The sizes manufactured at present range from 12½ h.p. to and including 75 h.p. The wide range of sizes in these outfits makes the fact evident that the power units are equally adaptable to either marine or stationary power plant service.

Oil Engine Used as Prime Mover

The heavy oil engine used is said to be sufficient guarantee of low cost operation, which of course results in a great saving in the cost of current generation. The engine is sold under a standard guarantee which specifies a consumption of fuel oil of .5 lb. per B.H.P. hour, using fuel as low as .28 Baume, containing not less than 18,500 B. t.u. per pound. It is said that every engine turned out must use less than the amount guaranteed on actual brake test; otherwise such guarantee could not be made with any degree of safety.

The engine illustrated has a brake output of 50 h.p. and is direct connected to a 30 K.W. 220 Volt D.C. generator, running at a normal speed of 425 R.P.M. It would therefore use 10,000 gallons of fuel oil per year, if operated 10 hours a day under full load for 300 days. This fuel costs on the average of 5 cents a gallon and would mean a total of $500 for annual fuel cost. This reduces the fuel-cost of current to $.005 per K.W. hour.

Construction of Generator

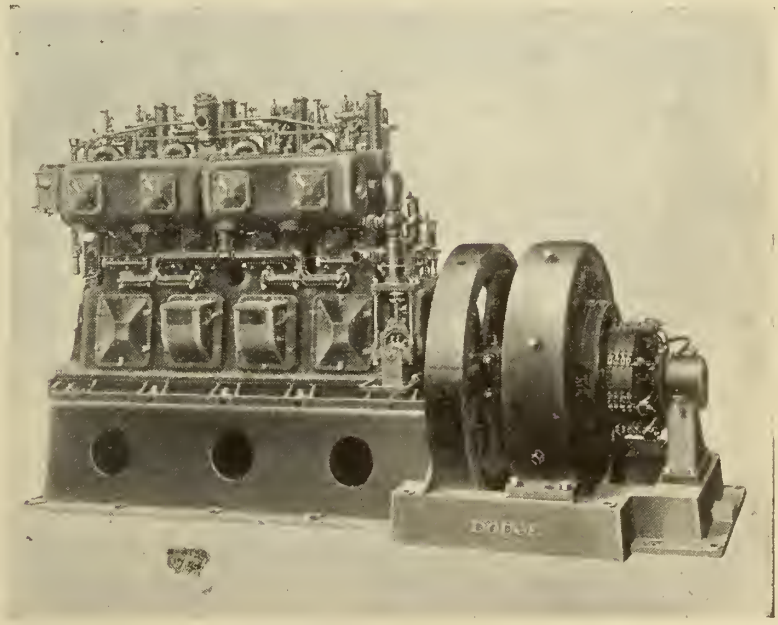
The generator used has been developed especially for this particular service by the Engberg Electrical & Mechanical Works at St. Joseph, Michigan. The armature is of the iron clad ventilated type, with laminated core, being built of electrical sheet steel, thoroughly japanned before assembling. The drum and core are provided with air ducts, permitting a thorough circulation of air through same.

Nothing but the very best double-covered magnet wire of the highest conductivity is used, and the insulation is thoroughly waterproof. A very desirable feature in connection with the armature is that it has been so designed as to eliminate a coupling on the armature shaft, the crankshaft coupling is direct connected to the armature drum, by such construction that the engine drives through the armature and not on the armature shaft. This method of construction is very substantial and makes it very easy to remove the armature—in fact this can be done without disturbing the engine in any manner whatever. Close regulation is assured by having the flywheel of the engine located close up to the armature and on the same end of the crankshaft.

The commutator is made of copper bars, insulated with the best grade of mica plate and is very heavy, thus insuring years of continuous operation without need of renewal. It is built up on a separate sleeve and bolted to the armature drum, so that the shaft can be removed without disturbing the windings. The bars are collected in a steel chuck, especially designed for this particular purpose, which is provided with large steel screws. The chuck is heated and allowed to expand, at which time screws are tightened to the very extreme. When the chuck cools and shrinks, the commutator is drawn into a perfect and lasting position.

Every part of both the engine and generator is of the highest possible grade in regard to material, workmanship and design. All bearings are extremely large and accurately fitted, thus assuring smooth and constant operation with comparatively little attention.

Both engine and generator are carefully tested and inspected at frequent intervals during the course of construction. Both are mounted on a heavy cast iron sub-base and dowelled in place, after which they are subjected to a final operating test under load.



GENERAL VIEW OF THE GENERATING APPARATUS.

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JOHN BAYNE MACLEAN, President. H. T. HUNTER, Vice-President
H. V. TYRRELL, General Manager.
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The British Empire Steel Corporation

THE British Empire Steel Corporation has not yet become an accomplished fact. The proceedings were started months ago by which several Canadian companies were to be brought together, and in future operated in line with others in the Old Country.

There have been violent changes in the stock market value of many of the holdings that were to have been included in the merger in the first place, and it has been possible several times to go into the market and buy these securities at a less figure than that at which they were to be included in the Corporation.

It is probable that there will have to be considerable alteration before the British Empire Steel Corporation is successfully handled by the underwriters. There has been a lack of information in several lines that has hindered the work and shaken the confidence of Canadian investors who were identified with the plan in the first place.

Several of the leading companies in the plan of reorganization have become so far committed to the proposal that it is unlikely that anything approaching the disruption of the plans will take place, but it seems not only desirable but necessary that there should be a new basis worked out before the plan can be successfully consummated.

Looking to the future, the iron ore deposits, the coal beds, and the limestone of the eastern section of the Dominion should form a rare combination in the carrying out of industrial dreams of promoters and workers. The situation is unique, right on the seaboard and with ready access to the markets of the world.

If, with all that, they cannot in time turn out steel in competition with the steel companies of the world, there must be something wrong that does not appear on the surface.

Exchange Rate Again

THE exchange rate is again at a point where it is causing serious thinking, during the past few days it having touched 15 per cent. on several occasions. It is not an uncommon thing to hear of buyers asking for the longest possible period of time in which to settle for shipments from United States, not because they have not the means to make payment, but because they hope for a better turn in the exchange situation, and the gaining of a few points will mean quite an item to them.

Others, again, have been fooled by doing this thing. They have held off to the last, hoping for a more favorable rate, only to find that instead of coming down the rate of exchange has been going up, and that each day delayed has cost them more money instead of saving them a few dollars as they had hoped.

It is no doubt desirable that we should sell more to United States and buy less from the people there. That, in theory, is very good, but the fact is that there are many things, especially in the world of iron, steel and machine tools that we must secure there or at other points outside this country.

YOU may stay out of the market so long that prices will have touched bottom and started on the way up again before you act. Staying out of the market is a doubtful way of making a success of anything.

* * *

LESS than a year ago a man with a pile of steel sheets in his yard was sitting on them surrounded by a shotgun and an axe for fear some one buyer would insist on taking the lot. Now said buyer can come in unmolested and take the heap.

What the Business Papers Say

Time for Them to Get Together

"Syren and Shipping."—The question is, as has been rightly remarked by Mr. Launcelot E. Smith, the chairman and managing director of Smith's Dock Company, not one of asking the men to accept low wages. If they will look after production, wages will look after themselves. If, he says, the British working man and the British employer will get together they can beat the world, but the men are hampered by their unions and the employers by their federations. When an employer of Mr. Smith's character talks in this strain, our opinion is confirmed that it is up to both sections to tackle this grave problem in earnest, and at once.

Says Men Value Their Jobs Now

"Iron Trade Review."—Workmen have begun to value their jobs again and it is well that they may for their own good. Trade depressions are great stimulants to individual efficiency. Under such conditions only the really efficient may be reasonably sure of their jobs, this as workmen, or their ability to compete, as manufacturers. The working out of the law of practical economics now is to be seen on every side. In the end it means restored prosperity to the machine tool and other industries.

About the Power of the Future

"Power."—It is no longer a problem where to find a market for oil, but where to find the oil to supply the market. What are we going to do regarding our oil supply? Shall we wait until it is exhausted, as is the supply of natural gas, when it will be too late to act, or shall we join with the rest of the world in drawing up a world policy to safeguard the future?

Criticizing English Motor Cars

"Engineering."—It is, of course, a purely commercial question whether or not this is a wise policy, and it may be that there is room for all these expensive machines, and that more profit may be made in selling a few large cars than a greater number of small ones. Even this seems doubtful, for the number of people who are at the present time prepared to spend very large sums on motors is probably not great, and the moderate-priced machine has improved so much of late years that there is not such a very great gain in having an extremely expensive one.

A Difference in Methods

THE "Railway Age" gives statistics of the operation of American and British railroads during the first six months of 1920. The article was prepared by the Bureau of Railway Economics and the figures regarding the British railroads are the first of the kind ever available.

The average freight rate per ton per mile on the British railroads, which are still under Government control, was, in the first six months of the year, 26.3 mills, exclusive of charges for the collection and delivery of freight to and from the railroad stations. The average rate on American railroads in the same period was 9.7 mills, or about one-third as great.

The principal reason why American railroads can haul freight at an average rate only one-third as great as that of the British railroads is that they handle it in so much larger units—that is, in so much larger carloads and train loads. The average number of tons carried in each train by the British railroads was only 150, while in the United States it was 710.

The average number of cars in each freight train in England was 35, which is about the same as the average number of cars in an American freight train, but the average load carried in each car in England was only 6 tons, while in the United States it was about 28 tons.

It was, of course, this great difference in the average number of tons carried in each car which was chiefly responsible for the much larger number of tons carried in each train in the United States.

On Bein' the Boss

IN years when things was movin' fast and cash was stalking 'round, when clinkin' dimes and nickels was an ordinary sound—I used to think in them there days before we felt a pinch, that bein' the boss around the place was one outstandin' cinch.

Why, say, we never worried much, things seemed to hump along, with everything a-breakin' right and nothing ever goin' wrong.

His golf friends came in after lunch to coax him from the scene, to go and whack the little pill and clod-hop on the green. He gave his orders right and left, by heck, it was a cinch, this job of bossin' on the works before we felt the pinch.

And I looked forward to the day when they would pussyfoot to me, and say, "young man, this job of boss is henceforth handed unto thee."

Ah, then I would sit down in ease, a rift of wisdom on my brow, I'd keep an auto and a farm, a bacon hog, likewise a cow. My feet I'd plant upon the desk, my wealth would prosper inch by inch—oh, bossin' the whole shootin'-match would be to me a pleasant cinch.

But since things aint so fresh just now as they was 'bout three months ago, I'm not so certain of the fun of bein' the boss around the show. Some funny things turn up these days between the mornin' and the night, and I hear them tellin' round the plant that money's gettin' powerful tight.

The boss aint quittin' early now, he's settin' tight around the place, they're stickin' grey hairs in his head and plantin' wrinkles in his face. There's papers piled upon the desk, enough to fill a good-sized cart, and he's figurin' this here thing and that, and squintin' hard upon a chart. He's sittin' there long after dark, and says we aint a-goin to bust, but he's puttin' on the pressure there and changin' off from may to must.

I use to think that bossin' job was one grand, easy, fat affair, but I aint a-hankerin' for them now to lead me forward to his chair.—Ark.

The Retroactive Award

THE manner in which retroactive wage awards work out in some cases makes a hardship that is very difficult for the company against which the award is made.

For instance, such an award was made in the case of the Nova Scotia Steel & Coal Co., in the case of the miners, and by the award the increase in the cost of producing a ton of coal was about $1.25. This does not mean that the miner got that amount extra for digging a ton of coal, but that the combined increases paid to the several men who handle the coal from the time it is taken from the working place in the mines until it is loaded and ready for shipment amounted to the $1.25 per ton on the output of the mine.

The wage award was made retroactive over a period of two months or so. The company, in some of its contracts covering the sale of coal, have a clause which makes the customer liable for this increase, and in such cases it is possible to recover the increase for these sales, but a great deal of coal is sold in the open market without any such clause.

When a manufacturer buys coal he uses it for his steam plant, it goes into the manufacture of some line, and is passed out to the trade in this way at a fixed price. The manufacturer has no chance to recover on the increase he has to pay, for his goods have been sold.

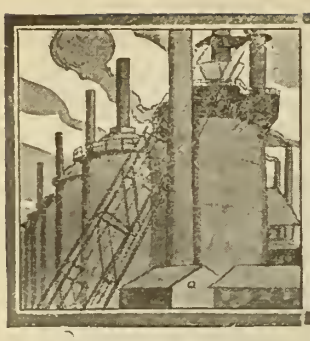
The coal company used at that time about sixty per cent. of its coal for its blast furnaces and open hearths, and the coal product was being sold to the customers of steel at current prices, with no string tied to the sale by which the buyer might find himself liable to an extra tax some two months after to pay for the increased cost of coal used in making the steel. In this case the coal company had no come-back.

An award that is made retroactive as a general thing leaves the company no chance to adjust its selling prices to meet the changed conditions, and is apt to impose a burden on its financial strength that it may not be able to bear without having to curtail seriously in some other direction.

THE scrap iron market is variously described by dealers as stagnant, dead, inactive, listless, lifeless, rotten, uninteresting, etc., Now, if any of our dear readers have a phrase that will nicely sum up these opinions, will he kindly shoot?



"I Wonder if he Has Really Reformed?"



MARKET DEVELOPMENTS



Buying Should Be Better in the New Year

Tool Buyers in New York Claim They Will Not Come Into the Market Until January—The Premium Market Has Simply Ceased to Exist—Exchange Once More a Serious Matter Here.

ONE might very well imagine that matters were dull indeed in the machine tool markets, and in the steel trade generally, were it not for the fact that occasionally a dealer comes along who has landed a very respectable order, and that at his regular price, without any special consideration. In the steel market it is to be expected that trade will be small in volume between now and the first week in January. The trade has always found it that way, and this year is no exception. Boiler tubes are much wanted just now, and that is the one line that moves best at this season. As soon as the boats tie up for the season work is started on repairing.

The exchange situation is again causing some serious thinking on the part of firms having shipments coming from United States points. They are in many cases asking for the longest possible time in which to take up the payment of their bills, hoping that the rate will turn a little in their favor. Some of them have been fooled by the recent rise, and their delay has cost them money instead of saving any for them.

The premium mills are getting very little business from the Canadian territory just now. In fact the premium market has ceased to exist. It may be some little time before the buyers here will get the full advantage of cheaper steel and iron.

The scrap metal market does not improve at all. Buyers are remaining out of the market. Dealers are not buying anything to speak of unless they have some contracts that have to be filled.

MONTREAL LOOKS FOR BETTER TRADE SHORTLY AFTER FIRST OF THE YEAR

Special to CANADIAN MACHINERY.

MONTREAL, Dec. 9.—Business at the present time seems to be regulated more by financial conditions than by the general trade requirements. There is little doubt that trade in general would be more brisk if the difficulty of financing was less pronounced. The problem of economic adjustment is one that requires considerable initiative and courage on the part of the manufacturers, as under existing conditions it necessitates carrying on, either at a loss or foregoing all profits during the period of clearing out old stocks and replenishing at the new basis. Even this policy is enshrouded in great uncertainty, as the declining prices offer little guidance as to the ultimate stopping point. This influences the trade to such an extent that buying all along the line is curtailed or restricted to the point that stocks, which normally would be disposed of in a reasonably short time, are carried over, with the result that further buying is postponed, the consequence being a temporary suspension of activity in many lines of industry.

Local Price Revision Expected

The revision of American steel prices to lower levels has not resulted in any pronounced activity on the part of consumers. It will probably be some little time before mills are turning out steel at the new base, but the movement of price reduction appears to be general and it is now a question whether the lower quotations will open the channels for renewed business. "We are now in a period when it is usually expected that business will be slack, and at the present time this dullness is emphasized, particularly when compared with that of the past several years, when the dull pre-winter months differed very little from other periods of the year. However, when the present is compared with corresponding months in pre-war days, there is very little to show where a striking difference can be drawn." This statement by a dealer here indicates that general business is quiet, but that too much stress is placed on the relative falling off between the activity created by abnormal world conditions and those which should obtain had the commercial trail been blazed in the ordinary peaceful manner

"It is logical to suppose," continued the dealer, "that a transient period must be passed through before a sound working base can again be established, but this will slowly right itself, and probably before spring we will see a healthy revival of industrial enterprise, but it is only after the tide begins to rise that full confidence will return and open the way to renewed activity. We are anticipating a revision of prices, but it will probably be the first of the year before these changes will be announced. It will be some time before American prices will affect this market, and in the meantime we will continue to quote present prices on warehouse material."

Little Demand for Machine Tools

General lessening of activity throughout the district has reacted to some extent on machine tool dealers, as reports are to the effect that business is more than seasonably quiet. In some respects it may be stated as exceptionally dull. Many of the factories in this locality have made reduction to their operating staffs, and while nothing definite can be learned as to the duration of curtailment, it is not thought likely that any marked effort will be made to replace or install new equipment until business has again resumed some of its former activity. The problem of selling machinery and supplies is becoming real work, as users are not as easily persuaded to the advisability of renewing tools. This attitude on the part of the consuming trade will likely mean a period of several months when buying of equipment will be restricted to the most urgent needs. Manufacturers realize that early adjustment is imperative, and this condition, while temporarily holding trade in suspension,

must obtain during the transition period. Dealers are far from being pessimistic on the future outlook, and many are confidently making plans for the coming year, in the hope and belief that before the spring the reversal of the tide will take place and the stability of the market be established. "We are a little reluctant to revert to former prices, but it is probably the best move after all, as such action is an essential factor in solving the problem of supply and demand. At the present time the trade is kept from buying by the weakening tendency of all commodities, a condition that is not conducive to active buying." This remark from a dealer apparently explains the prevailing dullness in many quarters.

Regular But Light Movement

The metal situation is keeping step with other lines of activity in gradually relinquishing the high hold on prices that have been the order of the day for many months. These lower quotations are the result of trade adjustment as much as to the falling off in demand. There is still reason to believe that solid ground has not yet been reached and further sinking will likely be reported. Local quotations show a further decline this week. Tin and aluminum are down one cent, the quotations being 44 cents and 34 cents respectively. Other ingot metals are down from ¼ to ½ cent per pound; electro copper is now 18½ cents, spelter 8½ cents, lead 7½ cents, and antimony 8 cents per pound. Movement of metals is light but quite regular.

Interval of Inactivity

Old materials are in a position where the market is conspicuous by the entire absence of any active interest. Dealers are unanimous in stating that there is "nothing doing." This applies generally, with the exception of such local trading as is necessary to carry on the regular business of the foundries in the district. Even this activity has been below normal for some time. Dealers are not particularly interested in prices, as the small demand offers little opportunity of reselling the material, and therefore they are not desirous of accumulating any excessive stock in face of the weakening market. The prices quoted are a fair average of what dealers here are paying but actual transactions would probably be carried on at figures slightly lower.

POINTS IN WEEK'S MARKETING NOTES

Large buyers have advised the machine tool trade that there will be no buying until the first of the year.

—

New York reports indicate that makers of machine tools are in no hurry to announce any reduction in price, believing that such a step would not bring any new business into the market.

—

Some of the American sheet mills are opening their books for new business now, but the Canadian sales office of the Corporation has not yet taken on any new business.

—

There is a rumor on the street to the effect that the price of sheets in Canada from American mills will be the same as the price at which they are sold in the United States, but there is no official confirmation of this report as yet.

—

The United States Steel Products announce that Canadian business will now be regarded as domestic by their mills. This comes back to the same position that they occupied some months ago, before the increase was put on Canadian orders.

—

The average independent steel mill in United States is not operating at much over 50 per cent. of its capacity at the present time, while the Corporation is running at 85 to 90 per cent.

—

Makers of pig iron have very little business on hand, and a number of the furnaces in the United States have blown out during the past week.

—

On account of the high exchange rate, many buyers who have shipments coming in from the United States are asking for as much time as possible in the hope that the exchange may be a little more favorable to them.

—

With the prospect of securing more power, dealers are looking forward to an improvement in the sale of motors, both for group and individual drives.

THE EXCHANGE IS BOTHERING THEM

Buyers Like Long Terms on U.S. Goods to Take Advantage of Any Drop

TORONTO.—One might imagine that the machine tool trade in this district were very quiet were it not for the fact that now and then on the way around the machine tool houses good sized orders are heard of. There is business moving, although it is not as good as it was some months ago, and those who study matters carefully believe that it is going to be better shortly after the break of the new year.

One of the Toronto men speaking about the matter this morning said his principals had announced no change in their selling prices, and if any were to be made at the first of the year the chances were that he would be advised of it by now, or have some tip that it was coming, although the policy of some houses is to send out their changes immediately. Some of them believe that prices of tools that are made up and in stock are such that they cannot cut them much, and that if there is to be a new price they will have to secure labor and material at a lower price.

The prospects of a better supply of power in this district will be reflected in the sale of motors very shortly. There is undoubtedly a marked preference on the part of many manufacturers for motor drive for group or individual machines, but it has not been possible to secure power enough, so the sale of motors of the voltage sent on the Hydro line has been much curtailed.

In the Steel Market

Few changes are announced in the steel market this week. There seems to be some little doubt as to what extent the new prices apply to Canadian trade. The Carnegie mills, for instance, announce that in their products, such as structurals, bar mill material, plates, etc., they will now regard Canadian business as domestic. This ruling applied from the first day of December, and all orders that were on the books before that time are not put down at the new price. This ruling is satisfactory to the trade, as it had been expected that the old price would stand where a definite figure had been named on a contract.

The American Sheet and Tin Plate books have been opened for business in the States, but so far their Canadian office is not taking on business, although it is expected that this will be the case here in a few days. Neither is there any official confirmation of the rumor that they had decided to regard Canadian business as domestic trade, although on the other hand it would cause no surprise were this to be confirmed.

Some of the warehouses are not ready to take on all the shipments that are being made in their direction. One of the dealers stated his case as follows: We have been month after month waiting for delivery of our orders, particularly in sheets. Much of this was seasonable business, and now that stuff is coming through faster and the demand is lower, there is a danger of them swamping us with material. This does not mean that we are going to cancel, for we want to place the material in stock, but it does mean that we are not going to allow the mills to take advantage of the situation now that deliveries are more in their favor. As long as they spread their deliveries over a period, well and good, but there is not going to be any smothering done if we can prevent it."

The Matter of Prices

Prices remain much the same in the local market. Galvanized sheets are not by any means plentiful, the mills

having been turning out only a limited tonnage.

Black sheets are not a plentiful article, and this condition is not likely to improve, as the mills are not turning out many of these. The independents are largely down to a low rolling rate per day. They have very little business on their books and are reducing staffs in keeping with the amount of business that is offering. In some lines the advantage still rests with the independents, because they are in a position to give almost immediate shipment out of stock, whereas there are many lines on which it is still impossible to book business with the Corporation.

Tubes are in good demand now, and a brisk business is being done. Of course there is nothing unusual in this, as it has been the same year after year. As soon as a ship ties up for the season work is started on repairing, and for the next two months the tube business ought to be a pretty fair trade.

Bar iron is selling well, but perhaps the most active line in this section is band iron, the stovemakers having requirements in this line at present.

The Matter of Exchange

Now that the exchange on Canadian funds in New York has gone up over the 15 per cent. mark, there is a tendency on the part of many buyers to urge as long consideration as possible, in order that they may have a chance to get something better a little later on. Some of them have recently been fooled on this, because exchange, instead of crawling down has shown a marked tendency in the other direction. Some of the firms selling steel in Canada give fairly long terms of payment, and at any time in that period the buyer can take advantage of any drop in the exchange rate and make his payment against the account. Especially now with the rate high again, buyers are watching every day to see if there is any advantage in their favor in the changing quotations.

THE PREMIUM MARKET DID NOT DIE— IT SIMPLY WENT AND FADED AWAY

Special to CANADIAN MACHINERY.

PITTSBURGH, December 9.—Two more important steel mill products, wire and sheets, have come down to the Steel Corporation or Industrial Board level, and only one large line, tubular goods, remains. The readjustment in pipe may not come for quite a while, for pipe continues in excellent demand, with heavy requirements against contracts and some new buying of no small consequence in the open market. Pipe stands quite alone among finished steel products.

In the wire product readjustment one large independent interest took the lead, reducing its prices to 3.25c for plain wire and $3.25 for nails, these being the Steel Corporation prices. The $3.25 on nails is an Industrial Board price. The 3.25c on plain wire is an advanced price, the Industrial Board price having been 3.00c, the American Steel & Wire Company having advanced its price on wire last August by $5, leaving nails unchanged. While it may seem strange to have wire and nails on the same price basis, the differential has never reflected the actual cost of manufacture. For many years it was 10 cents, and for a short period long ago it was only five cents. The 25-cent spread in the Industrial Board schedule was a relic of the war time control.

The other independent wire interests showed no alacrity in following the lead of the first independent. This indifference is to be attributed to the fact that there is scarcely any demand in the open market, hence little temptation to engage in competition, while perhaps it was thought that some of the contract tonnage remaining on books could be saved. One independent, for instance, offered to adjust 4.25c nail contracts to 4.00c. Another reduced its nail price from 4.25c to 3.75c instead of to 3.25c, although it did make the full reduction, to 3.25c, on plain wire.

The Decline in Sheets

At the time of last report the sheet market, on a really desirable order, was practically down to a level just $10 a ton or a half cent a pound above the Steel Corporation prices, although no mill was openly quoting altogether as low. For a few days the position of several mills was that while they were quoting $10 a ton above the corporation prices they were willing to do the corporation prices if they were offered a good sized order, say 1,000 or 2,000 tons. The difficulty was that no such business appeared in the market. At this writing it is clear that at least one mill would quote the Steel Corporation prices even on an ordinary order, not waiting for an impossibly large order. Hence the independent sheet market is now quotable at the Steel Corporation level.

Late last week the American Sheet & Tin Plate Company opened its order books for the new sales period, nominally the second half of the year in the case of regular manufacturing consumers, but practically for the second quarter, since about three months of work has to be carried over from this year's contracts, the holdover being due to the company not having been able to operate at capacity on account of steel and fuel shortage and car shortage, at various times over the past six months and more.

The prices are of course as formerly: Tin plate, $77 per base box for 100-lb; blue annealed sheets, 10 gauge, 3.55c; black sheets, 28 gauge, 4.35c; galvanized sheets, 28 gauge, 5.70c.

End of Independent Market

The famous and spectacular independent market for steel products has thus come to a mute and inglorious end, excepting in the case of pipe. No one, perhaps could have imagined the independent market giving out so quietly. It can hardly be said to have done so active and energetic a thing as to die. It simply faded away. There was no important business offered as an incentive. The independent mills that reduced their prices first did not get any business to speak of by the operation, nor has buying been stimulated to any appreciable extent. Such wants as the country has seem to be supplied almost wholly by the Steel Corporation which so far as can be ascertained is operating as well as at any time, say at between 85 and 90 per cent. It must be that a large number of buyers have been on the corporation books, making purchases from independents simply as the corporation's allotments to them were insufficient. With respect to much of the country's business, then, the independents were simply getting the overflow.

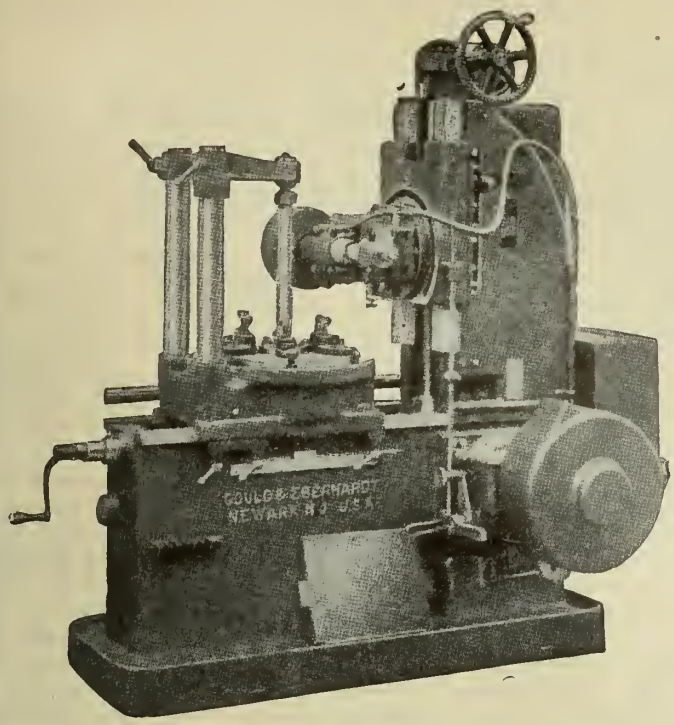
Independent Operations

The different independents are operating at various rates, and there is also much starting and stopping from week to week, so that a close estimate of the general average rate of operation by the independents is difficult. The common view seems to be that the independents are not operating at an average of over 50 per cent. In slack times it is a common practice for a mill to close for a time, to allow orders and specifications to accumulate for a moderately full run, and it is considered probable that many mills will seize upon the last fortnight of the year as a good time in which to close. Thus the year may end with the independents almost altogether closed. As for the Steel Corporation, it looks as though it would be able to maintain a moderately full rate of operation for months even if there is no improvement in the general situation.

Manufactured Steel

Declines in the hot rolled products are naturally working their way through to the manufactured products. Cold finished steel bars have come down from 4c to 3.60c. Bolts and nuts have been reduced various amounts, averaging about 20 per cent. Rivets have not been formally reduced. For some time there has been shading of the old official price of 4.75c to 4.50c and 4.35c, but a reduction in keeping with the declines in hot rolled steel is expected to carry the market down at any rate to 4c. Chain is still nominally at 7.25c.

Hot and cold rolled strips have been reduced a cent a pound from the old official price and a half cent from the market actually existing in the past two or three weeks, the new prices being 4c



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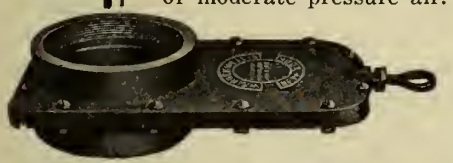
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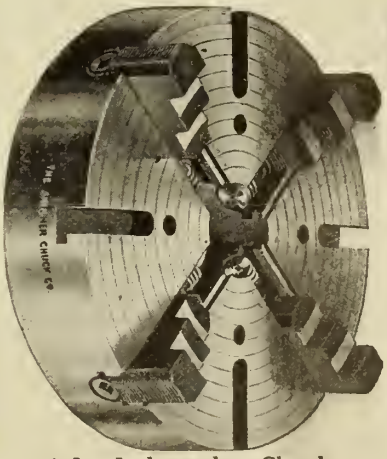
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for hot rolled and 7c for cold rolled. The producers did not expect to get any new business of consequence by the reduction, and state the reduction was made chiefly for the purpose of adjusting contracts on books at higher prices, so that customers would be free to file additional specifications.

Foundry pig iron is still quotable nominally at $37, valley, and perhaps this is so chiefly because there has been no inquiry to tempt producers to make lower quotations. On quotations made voluntarily by furnaces rather than in response to important inquiry Bessemer is down $2.50 to $35, valley, and basic $2 to $33, valley. It is possible that these prices will hold for several weeks. No great decline, at any rate, is to be expected until there is enough business developed to promote active competition. As matters stand the furnaces are rapidly running out of business and have nothing to do but blow out. Of the 13 merchant furnaces in the Mahoning and Shenango valleys seven are out and the six still in blast are referred to as being "on the ragged edge." Perry at Erie is out.

BUYERS ARE OUT OF THE MARKET

Special to CANADIAN MACHINERY.

May Come in at First of the Year if any Inducements are Held out to Them

NEW YORK, December 9.—(Special to Canadian Machinery).—Most of the large prospective buyers of machine tools, which includes the railroads and companies such as the General Electric Co., have advised machine-tool dealers and sales representatives that there will be no buying until after January 1. They do not even promise for a certainty that there will be buying at that time, but the intimation is given that if other conditions, such as credit and prices, are satisfactory they may do some buying early in the new year. The General Electric Co. has plans for continued expansion, but these plans have been held in abeyance for many months. Quotations have been received by this company in the past several months on scores of tools, which have not been bought, and if orders for the entire number inquired for should be issued early next year it would have a very beneficial effect in stimulating the market.

November was an exceedingly dull month, and there is even less buying so far in December. With the inventory period so close at hand, it is natural to expect that even urgent requirements will be put off until the new year.

Little has been heard lately regarding prices. There are so few buyers in the market that the subject is not brought up with the same frequency and insistence that prevailed a month or so ago. Machine-tool builders are principally concerned in getting their present orders shipped. There is a good deal of talk about an adjustment of wages for labor before the machine-tool industry starts out on a new price basis.

MANY CHANGES TO BE MADE IN BRITISH EMPIRE STEEL CORPORATION

A REPORT in a Montreal paper says that the British Empire Steel Corporation is to be dropped entirely. The paper goes on to say:

"The probability of this being the fate of the venture has been a subject of much discussion in financial circles for weeks past, but in circles close to merger interests no admission in the connection was available.

"It is now generally admitted both in Montreal and London circles close to the company that it will be impossible to carry out the financial arrangement necessary to the completion of the contracts with the various units of the merger, and that in consequence it will be impossible to proceed.

"On the other hand it is generally understood that an alternative scheme will be an arrangement to bring Dominion Steel and Nova Scotia Steel together, but all the other units are to be dropped.

"The proposition was one of the most ambitious ever undertaken in connection with Canadian industries, and the need of letting the matter drop will be heard with genuine regret by many Canadians who believed that as a constructive scheme it had many fine and attractive qualities, particularly with respect to the support it promised to bring from the Mother Country.

"The programme had been carried through up to the point where all that practically remained to be done was to bring out the issue of $25,000,000 of 8 per cent. preferred stock of the corporation, and the money market in London has been most unreceptive for a long time and the issue was put off from time to time in the hope that it would improve."

This report is not in keeping with one received by Canadian Machinery this week from one of the officials connected with the deal from the very start. He admitted that there were obstacles in the way which had prevented the underwriters from finishing their work, but those connected with the deal had committed their companies to it to such an extent that it would be impossible to call the deal off. It seems that the details will have to be worked out on a new basis as the figures used in the first instance have been found to be unsatisfactory. The official giving information to this paper did not know for certain when the deal would go through, but intimated that for the present there was nothing being done.

Equipped at Cost of a Million, Will Cater to the Needs of Western Canada

The first open-hearth reverberatory furnace in Manitoba recently commenced operations at Selkirk, about ten miles northeast of Winnipeg.

The plant, which represents an investment of about $1,000,000, is known as the Manitoba Rolling Mills, and its equipment is said to be of the most modern type, consisting principally of one 15-ton furnace, three 15-ton ladles, crane, dumps, molds, and other machinery. Electricity is supplied by the Winnipeg hydro-electric stations.

It is expected that the surrounding territory will furnish an ample quantity of steel scrap.

The fuel used by the new rolling mill is Canadian bituminous coal, crushed into 1-inch cubes, elevated into a hopper, passed through a dryer, and from there into a pulverizer.

Orders have been received which will engage the output for several months, it is reported, but shortage of labor, high freight rates, and the scarcity and high cost of raw materials imported from the United States are said to have hindered capacity production. It is expected that the output of this plant will supply in a measure the demands of the market in Western Canada and that additional units will be equipped as fast as business warrants.

MALLEABLE IRON MEN STATE CASE

A Basic Industry, and Its Worth Proved By Experiences During the Great War

Presenting a memorandum on behalf of the various Canadian manufacturers of malleable iron, F. L. Storey addressed the Tariff Commission. Mr. Storey pointed out that the American industries of a similar nature, with their immensely larger market, operate under a condition of mass production which is non-existent and unattainable with the Canadian foundry in sparsely-populated Canada. If the tariff were removed these United States plants could reduce the selling field of Canadian manufacturers by their competition. Another handicap against the Canadian foundry is that the laid down costs of raw materials are greater than those of the U.S. foundries. This extra cost arises from the duty which the Canadian manufacturer has to pay on pig iron, coal and fire brick and the extra freight to Canadian foundry points.

He submitted these figures in respect to the Canadian malleable iron industry: Capital employed, $2,605,000; wage roll (yearly), $3,410,000; output, $6,816,000; employees, 2,634. "This," he argued, "is a key industry, and the war has taught each country the necessity for its protecting and preserving its key industries."

Make Screw Cutting the Most Satisfactory Operation in Your Shop

Others have done so by equipping with

Geometric Screw Thread Cutting Tools

Wherever Screw Machines and Turret Lathes annex a Geometric Die Head or Collapsing Tap,

PRODUCTION Goes Up and COSTS Goes Down

Prove for Yourself

what a Geometric installation will do for you.

Tell us the specifications of your work, and the kind of screw machine used, and we will make you a proposition.

THE GEOMETRIC TOOL CO.
NEW HAVEN, CONN.

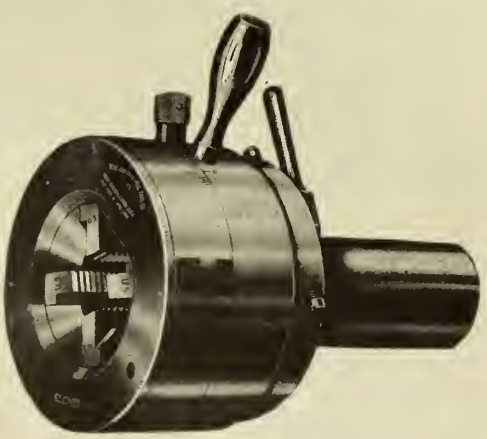
Canadian Agents:

Williams & Wilson, Ltd., Montreal
The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg, St. John, N.B., and Halifax, N.S.

Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta

FREE TO YOU

Geometric Die Heads



Instructions for Their Care and Use

HAVE you one of these pamphlets on the Care and Use of Geometric Die Heads?

YOU WILL WANT THIS BOOKLET SOMETIME

Are you using Geometric Die Heads?

YOU WILL WANT IT NOW

If not using Geometric Die Heads now, you will want it later, when

YOU DO USE GEOMETRIC DIE HEADS

It is a small 11-page pamphlet, 6 in. x 4½ in., which tells you how to take care of your Die Heads.

WRITE US FOR YOUR FREE COPY

A post card request will bring the booklet to you, and placed in the hands of the man who uses the Die Heads, it will help

CUT DOWN EXPENSE

If interested tear out this page and place with letters to be answered.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$39 96
Lake Superior, charcoal, Chicago.	53 50
Standard low phos., Philadelphia.	44 79
Bessemer, Pittsburgh	41 96
Basic, Valley furnace	37 50
Toronto price:—	
Silicon, 2.25% to 2.75%	57 50
No. 2 Foundry, 1.75 to 2.25%	56 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 75
Steel bars, base, Montreal	5 75
Reinforcing bars, base	5 50
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	8 50
Chequered floor plate, ¼ in.	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	3 50
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	5 50
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 67 to 5 50
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	58½	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

METALS

	Gross. Montreal	Toronto
Lake copper	$19 00	$19 50
Electric copper	18 50	19 00
Castings, copper	18 00	19 00
Tin	44 00	46 00
Spelter	8 50	9 00
Lead	7 50	8 00
Antimony	8 00	9 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 6 50	$ 7 00
Plates, ¼ up	6 00	6 60

PIPE—WROUGHT

Standard Buttweld Pipe

Per 100 Ft.

	Steel Blk.	Steel Galv.	Gen. Wrought Iron Blk.	Gen. Wrought Iron Galv.
⅛	$ 6 50	$ 8 50	$.....	$.....
¼	5 31	7 41	5 91	8 01
⅜	5 31	7 41	6 91	8 01
½	7 10	8 63	7 95	9 48
¾	8 80	10 87	9 95	12 02
1	13 01	16 07	14 71	17 77
1¼	17 60	21 74	19 90	24 01
1½	21 04	25 99	23 79	28 74
2	28 31	34 97	32 01	38 67
2½	44 75	55 28	....	....
3	58 52	72 29	....	....
3½	74 06	90 62	....	....
4	87 75	107 37	....	....

Standard Lapweld Pipe

Per 100 Ft.

	Steel Blk.	Steel Galv.	Gen. Wrought Iron Blk.	Gen. Wrought Iron Galv.
2	$32 01	$ 38 67	$35 71	$42 37
2½	48 26	58 79	54 11	64 64
3	63 11	76 88	70 76	84 53
3½	75 90	92 46	85 10	101 66
4	89 93	107 55	100 83	120 45
4½	1 05	1 29	1 30	1 54
5	1 22	1 50	1 52	1 80
6	1 58	1 95	1 97	2 33
7	2 06	2 53	2 53	3 01
8L	2 16	2 66	2 66	3 16
8	2 49	3 07	3 07	3 64
9	2 98	3 67	3 67	4 36
10T	2 77	3 41	3 41	4 05
10	3 56	4 39	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.

4½" and larger, 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%.

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices

	Per 100 Pounds. Montreal	Toronto
Copper, light	$10 50	$10 50
Copper, crucible	13 00	12 00
Copper, heavy	12 50	12 00
Copper wire	12 50	12 00
No. 1 machine composition	13 00	12 00
New brass cuttings	7 00	9 00
Red brass turnings	10 00	10 00
Yellow brass turnings	7 00	7 50
Light brass	5 00	5 00
Medium brass	6 50	6 00
Scrap zinc	5 00	5 50
Heavy lead	5 25	5 60
Tea lead	2 50	3 00
Aluminum	16 00	16 00
	Per Ton	Gross
Boiler plate	13 00	12 00
Malleable scrap	20 00	23 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	23 00	25 00
No. 1 machine cast iron	32 00	33 00
Pipe, wrought	9 00	10 00
Car wheel	30 00	33 00
Steel axles	20 00	20 00
Mach. shop turnings	8 00	9 00
Stove plate	25 00	25 00
Cast boring	8 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	+10
Carriage bolts, ⅜-in. and less	Net
Coach and lag screws	—15
Stove bolts	55
Wrought washers	—25
Elevator bolts	+10
Machine bolts, 7-16 and over	+10
Machine bolts, ⅜-in. and less	+10
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 50
Nuts, hex., tapped	add 3 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent.
Set screws —20% 25 and	5
Sq. and hex. hd. cap screws	12½
Rd. and fil. hd. cap screws	plus 25
Flat but. hd. cap screws	plus 50
Fin. and semi-fin. nuts up to 1-in.	12½
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	—5
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	+12½
Studs	+5
Taper pins	—12½
Coupling bolts	+40
Planer head bolts, without fillet, list	+45
Planer head bolts, with fillet, list plus 10 and	+55
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	+60
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add +85
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails, base	$6 10
Cut nails, base	7 00
Miscellaneous wire nails	50%

ROPE AND PACKINGS

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

ATKINS

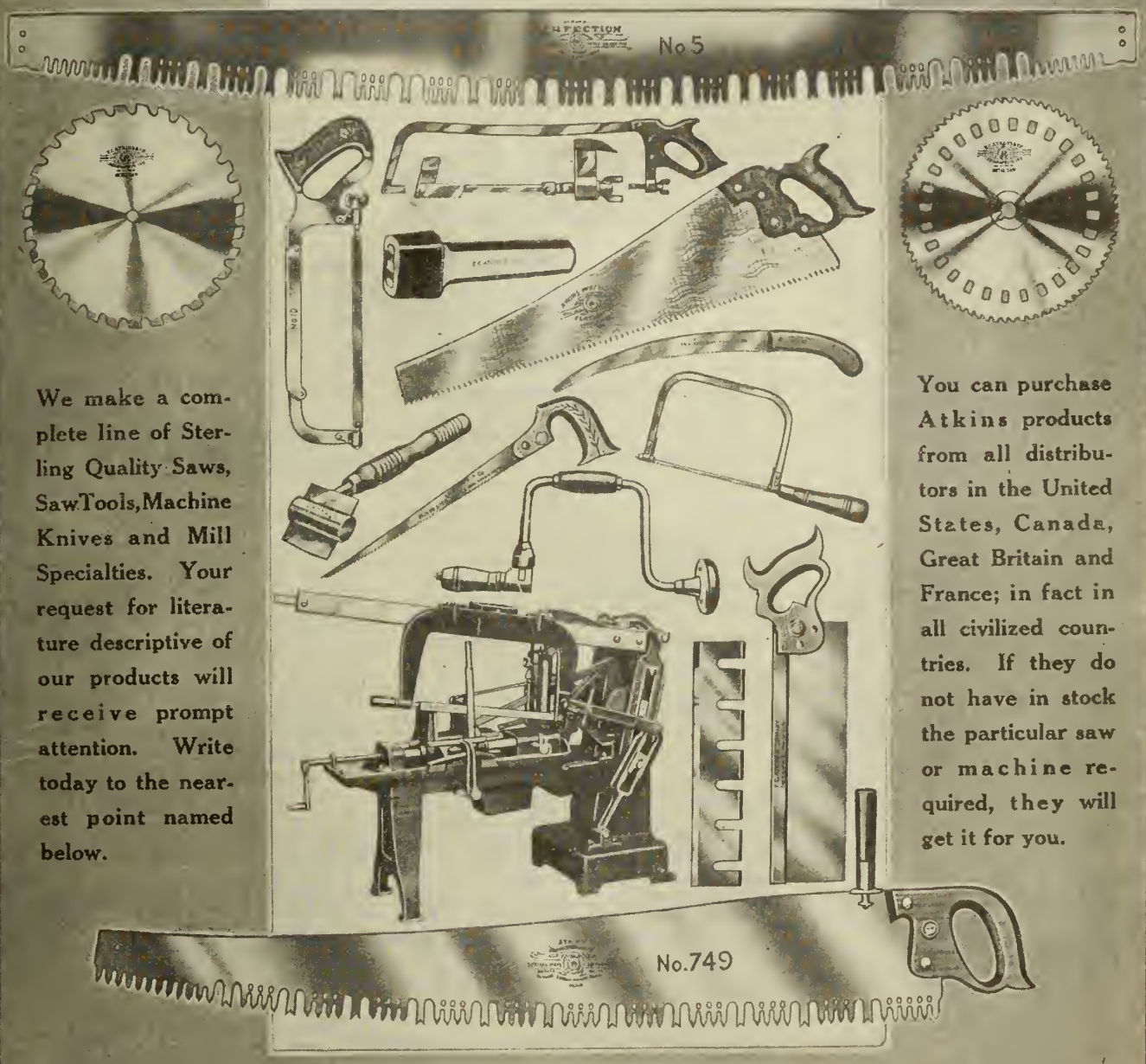
STERLING QUALITY

SAWS and TOOLS

A Perfect Saw for every Purpose

"Finest on Earth"

"Finest on Earth"



We make a complete line of Sterling Quality Saws, SawTools, Machine Knives and Mill Specialties. Your request for literature descriptive of our products will receive prompt attention. Write today to the nearest point named below.

You can purchase Atkins products from all distributors in the United States, Canada, Great Britain and France; in fact in all civilized countries. If they do not have in stock the particular saw or machine required, they will get it for you.

If you have difficulty in obtaining Atkins Saws and other products through your regular service, write

E. C. Atkins & Company

Established 1857

Canadian Factory: HAMILTON, ONTARIO

Branch: VANCOUVER, B. C.

MISCELLANEOUS

Solder, strictly	$ 0 28½
Solder, guaranteed	0 30½
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	20 35
Red dry lead, 100-lb. kegs, per cwt.	15 00
Gasoline, per gal., bulk	0 42
Pure turp., single bbls., gal.	3 15
Linseed oil, raw, single bbls.	2 37
Linseed oil, boiled, single bbls.	2 40
Wood alcohol, per gal.	4 00
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S.S. drills, wire size	35
Can. carbon cutters, plus	10
Standard drills, all sizes	35
3-fluted drills, plus	10
Jobbers' and letter sizes	35
Bit stock	40
Ratchet drills	10
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers, carbon	50
Centre reamers	5
Chucking reamers	net
Hand reamers	10
High speed drills, list net to plus	20
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	70	85
Class B	30	40
Class C	20	30

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 9 25	$ 9 50
Sheets, blue ann., No. 10	7 75	8 50
Canada plates, dull, 52 sheets	13 00	13 00
Can. plates, all bright	14 00	.....
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	13 00	.....
Fleur-de-Lis, 28 B.W.G.	12 50	.....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	12 00
Premier, 10¾-oz.	11 50	12 40
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	35 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	29½
Palacine	32½
Machine oil, per gal.	65
Black oil, per gal.	34
Cylinder oil, Capital	1.01
Petroleum fuel oil, bbls., net	19

BELTING—No 1 OAK TANNED

Extra heavy, single and double	6½
Standard	6½
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 30
Brass sheets, 24 gauge and heavier, base	0 38
Brass tubing, seamless	0 42
Copper tubing, seamless	0 44

WASTE

XXX Extra	.24
Peerless	.22½
Grand	.22½
Superior	.22½
X L C R	.21
Atlas	.20
X Empire	.19½
Ideal	.19
X Press	.17½

Colored

Lion	.17
Standard	.15
No. 1	.15
Popular	.13
Keen	.11

Wool Packing

Arrow	.35
Axle	.28
Anvil	.22
Anchor	.17

Washed Wipers

Select White	.20
Mixed colored	.10
Dark colored	.09

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades ... 15%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$35 00	$37 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	40 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	43 00	46 00
Copper sheet, planished, 16 oz. base	47 00	50 00
Braziers', in sheets, 6 x 4 base	39 00	42 00

LEAD SHEETS

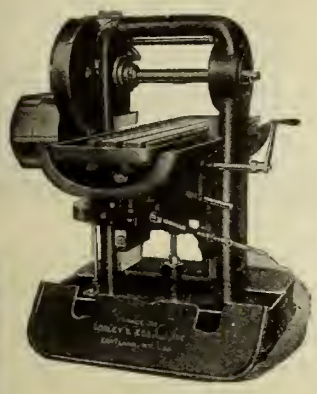
	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 50	$14 50
Sheets, 3½ lbs. sq. ft.	10 25	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 00	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

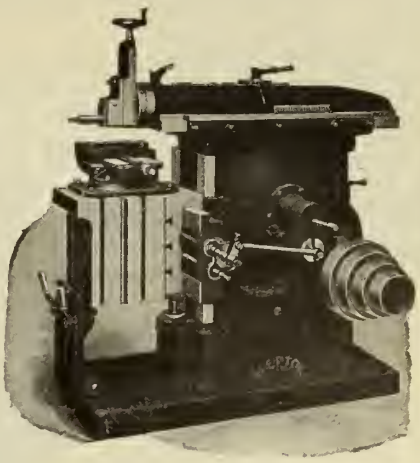
Acid, boracic	$ .23
Acid, hydrochloric	.04¾
Acid, nitric	.11
Acid, sulphuric	.04½
Ammonia, aqua	.15¾
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.16
Copper, carbonate, annhy	.41
Copper, sulphate	.13
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.20
Nickel carbonate	.32
Nickel sulphate	.20
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lbs	9.00
Sodium phosphate	.15
Tin chloride	.30
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated



GARLOCK-WALKER'S

LIST OF METAL WORKING MACHINERY IN DUFFERIN STREET WAREHOUSE, TORONTO



Lathes—Engine

All sizes of Engine Lathes for 7" x 32 to 36" x 18' with D.B.G. or S.B.G., some with taper attachments.

Lathes, Gap

1—C.M.C. 20" x 36" x 12' Q.C.G., D.B.G., taper attachment.
1—South Bend 21" x 30" x 7' D.B.G., taper attachment.
1—Perfect 12" x 17½" x 6' Gap Engine Lathe.
1—McDougal 22 x 40 x 18 D.B.G. Gap Engine Lathe.
1—Bertram 38 x 54 x 12 Gap Lathe.
1—LeBlond 33 x 60 x 16 D.B.G. and Q.C.G. complete with chucks.

Turret Machines

Milholland, Davis, Oliver make of various sizes and capacities, with full equipment.

Screw Machines

Foster, Prentice, Warner & Swasey and Cleveland, National Acme Automatics.

Drills

3—Woodward & Rogers 4-spindle, ½ in. capacity.
1—Edlund 1B High Speed Sensitive.
1—3-Spindle Silver Gang Drill.
1—20" Rockwell B.G. Power Drill.
1—20" Silver Drill, all geared.
2—20" Champion, all geared Power Drills.
1—36" Bertram B.G. Drill.
1—36" D8 Colburn Drill.
2—No. 1 Burke 10" Sensitive Bench.

Shapers

1—24" McGregor-Gourlay.
1—16" Rae Shaper.
1—14" McKenzie Shaper.
3—14" Davis Crank Shapers.

Grinders

1—12 x 42 Landis Plain Grinder.
1— 8 x 36 Fitchburg Cylindrical.
1—10 x 25 Q.C. Bath Universal.
1—No. 12 Gardner Disc Grinder.
1—Globe Universal Tool and Cutter Grinder
1—Stevens Universal Tool and Cutter Grinder.
1—Lafayette Universal Grinder for lathes.
2—Whitney No. 23 Internal Grinders.
Emery Grinders, Pedestal, bench type.

Millers

2—Briggs Type B42 Traverse (manufact'g).
1—Briggs Type A22 Traverse (manufact'g).
1—No. 1 Bertram Universal with Dividing Heads.
1—No. 2 Ford-Smith Plain Miller.

Compressors

1—12 x 13 Bury with tank and fittings.
1—10 x 18 Belt Driven Ingersoll-Rand.
1—8 x 8 Sullivan Compressor.

Shears, Punches, etc.

1—Ryerson No. 3 Rotary Bevel Shear, 1 in. capacity.
1—4 in. Stroke Double Arch Press Geared.
1—Lennox Rotary Splitting Shear, 24" stroke capacity, ½" plate.
Several small Punches and Shears to ½ in. capacity.

Hack Saws

1—Racine No. 10 Power Hack Saw, 8 x 8 capacity.
1—Peerless Power Hack Saw, 6 x 6 capacity.

Furnaces

1—Bellevue Double Chamber Oil Furnace.
1—12 x 15 x 8 Gas Furnace.
1—18 x 11½ x 8 Gas Furnace (West Magott).
1—24 x 18 x 12 Oil Furnace (Gilbert & Barker), with tank blower and pyrometer.

Miscellaneous

1—Morris Portable Crane, 1½-ton capacity, 10 ft. lift.
1—Canton No. 2 Portable 2-ton Crane.
1—Canton No. 2 Portable 1-ton Crane.
Several Hydraulic and Vacuum Pumps.
Several Blowers, Pressure and Exhaust Fans.
Grant Rotary Riveter, capacity 3-16.
Dividing Head for Miller.
Miller Vise.
Several Chucks.
Valve Milling Machines.
Transmission Supplies.
Several Greenard Arbor Presses.

Woodworking Machinery

We have complete stock of machines for all woodworking operations.

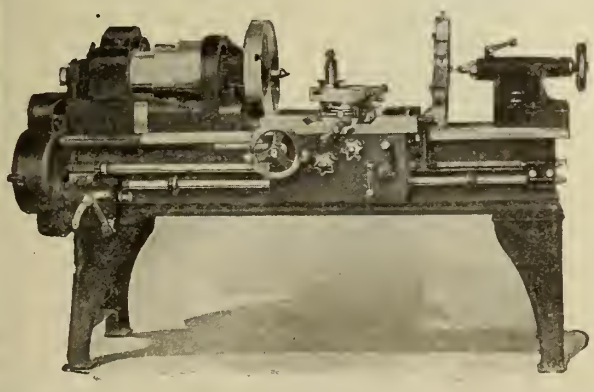
Boring Mills

1—Bement-Niles 66" 2 heads—25" under cross rail.
1—Niles 38" Vertical Boring Mill.
1—Bertram Horizontal 3½" Spindle, 60" between centers.
1—Universal No. 2½ Horizontal Boring Machine.

It will be to your advantage to let us have your enquiries

Garlock-Walker Machinery, Limited

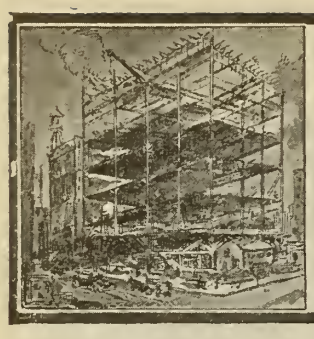
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"Everything in Metal Working and Wood Working Machinery"



If interested tear out this page and place with letters to be answered.



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES



A new municipal building is planned by the council, at St. John, N.B.

Brantford, Ontario, is contemplating the erection of a technical school at an estimated cost of $320,000.

The Merchants Bank of Canada will erect a branch on the northwest corner of Danforth and Ellerbeck Avenues, Toronto.

The Board of Education, London, Ont., are planning the building of public schools next year at an expenditure of $200,000.

The Cross Fertilizer Co., Ltd., Welland, Ont., has bought a 15 acre site and construction will begin in the spring on their new $250,000 plant.

The Andrews Wire Works of Canada, Ltd., Watford, Ont., is building an addition to its plant which will provide an additional 10,000 sq. ft. of floor space.

The Frost & Wood Co., Ltd., Smith's Falls, Ont., is in the market for a 10-h.p., General Electric or Westinghouse motor, 60 cycle, three-phase, 440 volts, 1,200 r.p.m.

It has been recommended by School Inspector J. S. Gordon that five new schools and forty-four additions be erected at Vancouver, B.C., at a cost of $1,246,000.

A. F. Stewart, engineer, Moncton, N.B., is receiving bids for the construction of a 350-ton mechanical coaling plant at Chaudiere Junction, Que., for the Canadian National Railways, Moncton.

A company in which B. L. Banford is interested will be incorporated to take over a factory at Listowel, Ont., and install new equipment at a cost of $50,000 for the manufacture of steel, wire and wooden wheels.

The Waltham Grinding Wheel Co., of Canada, Ltd., Brantford, Ont., has been incoporated with a capital stock of $200,000 by James Chisholm, Thomas B. McQuesten, Norman R. Robertson and others, all of Hamilton, to manufacture grinding wheels, tools, etc.

The Flexible Shaft Co., Ltd., Toronto, has been incorporated with a capital stock of $40,000 by Richard W. Hart, 67 Yonge street; Charles H. C. Leggott, 116 Arundel Avenue; Lewis A. McHugh and others, to manufacture power transmission machinery and appliances, tools, etc.

COMES BACK TO TORONTO OFFICE

T. B. Reid In Charge of Railway Equipment at the A. R. Williams Company

Mr. T. B. Reid, who for the last couple of years has been in charge of the A. R. Williams Machinery Co. business at Buffalo, has returned to the parent organization, and the Buffalo business has been discontinued for the present.

Previous to taking charge of the Buffalo office, Mr. Reid had been with the company in the capacity of manager of the machine tool department, having held that position from the year 1906 to 1916. Especially during the fitting out



T. B. REID.

of war shops did Mr. Reid come into close contact with the Canadian and American trade.

The department of the A. R. Williams business over which Mr. Reid will have charge is that of railroad equipment, which is being reorganized and enlarged.

Mr. Reid received his mechanical training in the first place in the Waterous Engine Works at Brantford, from there going to the machine tool and locomotive shops of United States. Returning to Canada he took up the selling end first with the Fairbanks-Morse Co., and then in 1906 with A. R. Williams, having been in the employ of this company ever since.

$300,000 plant will be erected by the Imperial Oil, Ltd., at Brandon, next spring.

Philip Gies, Water street, Kitchener, Ont., is erecting an addition to his foundry at a cost of $30,000.

The building permits issued since January 1st, by E. H Rodgers, city building inspector, for Winnipeg, total $8,200,000.

The United Rubber Mfg. & Reclaiming Co., Ltd., 1189 Bathurst street, Toronto, Ont., will build an addition to cost about $50,000.

The Page-Hersey Tubes, Ltd., 100 Church street, Toronto, is in the market for a 50-h.p. horizontal return tubular boiler to operate at 60-lb. pressure.

Construction work will begin at once on the University of British Columbia. The necessary roads will be built immediately and land clearing on the University site carried out.

The Huron Specialty Casting Co., Goderich, Ont., is contemplating establishing a foundry and manufacturing plant and is asking the city to erect a building, sell it to the company and grant the usual exemption from taxes.

Modern Implements, Ltd., Walkerville, Ont., has been incorporated with a capital stock of $100,000 by Charles D. Donaven, William J. Davidson, Thomas S. Biggar and others to manufacture implements, tractors, tools, etc.

The Sterling Action & Piano Co., Toronto, acting for an English company, has purchased a block of land at the corner of Church and Newcastle streets, New Toronto, where it is proposed to erect a factory for the manufacture of musical instruments, accessories, etc.

Work at Belleville.—The Tivani Steel Company, Belleville, have leased their property to H. S. Pertmore to do custom work in smelting ores. It is proposed to extract silver, gold, copper and iron from ores, an abundance of which exists in North Hastings. New blast furnaces are being installed.

Work all Winter.—The dredge "Cyclone," the largest thing of its kind in the world, is not to be stored away for winter but is being taken to the Chippewa Power Canal, where it will continue "to eat up" sand all winter. The big craft will be a great assistance in getting more power for Ontario on the Hydro development.

MORROW

High Speed Forged Drills



For More Holes With Less Regrinding

IF you want quality products and good service send to *Morrow* for your Cap Screws, Set Screws, Engine Studs, Semi-finished Nuts and Special Screw Machine Parts.

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7 Hop Exchange, Southwark St., London, Eng.

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THE "FLU" Stayed out of this PLANT

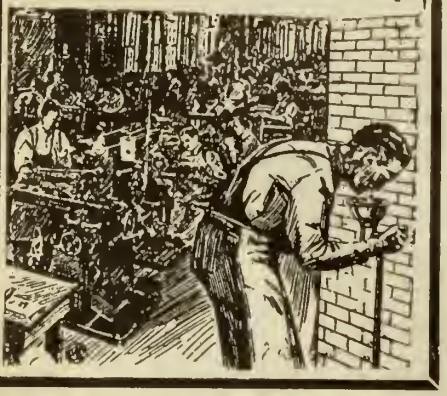
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(MADE IN CANADA)

The only fountain with a bowl that prevents lips touching the bubbler paid its moderate cost over and over in all those well-ordered plants whose precautionary measures successfully barred the Spanish influenza. PURO saves lives, time and water. Write

Puro Sanitary Drinking Fountain Co.

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Send us your blueprints and specifications. Entrust your requirements to experienced workmen and up-to-date equipment. Have your dies made in Canada. First-class workmanship guaranteed.

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Thorold Road, St. Catharines, Ont.

HAMILTON ENGINEERING SERVICE
LIMITED

Consulting and Designing — Tools, Jigs, Fixtures and Special Machinery. Let us shoulder your problems.

17 MAIN ST. EAST, HAMILTON

Montreal

The plant of the Anglo-Canadian Wire Rope Company, at Rockfield, Que., is now in operation. Some of the machinery has yet to be installed, but it is expected that the factory will be working to capacity early in the New Year. The Canadian B. K. Morton Company, of Montreal and Toronto, are the selling agents for the wire company.

T. W. Lesage, for eleven years superintendent of the Montreal Waterworks Department, will resign from the city service at the close of the year. Mr. Lesage entered the service of the city thirty-three years ago, and his start was in charge of construction work. In 1890 he was appointed assistant engineer to the city surveyor. In 1900 he was transferred to the waterworks department, taking the position of assistant superintendent. In 1911 he succeeded Major Georges Janin as superintendent. A year ago he was superseded by Supt. Terrault, and for the past twelve months Mr. Lesage has acted in the capacity of consulting engineer for the city.

The Engineering Equipment Company, Limited, sales engineers, dealing in mining, contracting and industrial machinery and supplies, have opened offices at 263 St. James Street, Montreal. The company has secured the exclusive selling rights for many leading lines of such equipment from firms in the United States and Great Britain, as well as many in Canada. The officers of the new company are: president, Norman M. Campbell, late general sales manager of the Canadian Ingersoll Rand Company; vice-presidents, Samuel Seaver, formerly Canadian sales manager for Sullivan Machinery Company and Canadian Rock Drill Company of Toronto; and Fred H. McKechnie, of McKechnie & McLaren, sales engineers of Montreal. Percival J. Woolf, late manager of the General Electric Company at Duluth, is the secretary-treasurer.

Scrap Metal Market

The trend of the scrap metal market is still lower. The reduction in prices has failed to bring any business which reacts toward further softening. A change in the market is expected at the beginning of the year.

On the Chicago market iron and steel scrap is practically at a standstill. Consumers are not interested. Rerolling rails, which have been fairly high, are dropping as a result of the lack of demand for bars produced from them. They can be obtained at present at $18 to $19 Chicago, but there are practically no buyers. Railroad offerings are moderate.

Many small dealers are feeling the lack of demand in the Boston district, and as a result prices are exceedingly low, and cancellations, rejections, and sacrifice sales are appearing in increasing numbers. Inquiries have dropped off from outside points and as a result mills are starting to cancel contracts. One mill during the week cancelled an order of thirty cars with a local firm.

The New York market is very weak. Quotations generally are nominal as trading is listless.

Quotations are largely nominal in the Pittsburgh district. The small sales which have been made during the week show a decline in price of from $2 to $10.

It might be said that there is no scrap market at Buffalo, as no buying of any kind is being done and dealers who are completing old orders are doing so from material already purchased.

A slight improvement has taken place in the Cincinnati district. Indications show that there may be a revival about the first of the new year. There has been no change in price since the recent downward revision.

Trade Gossip

Get Contracts.—The Mackinnon Steel Co., of Sherbrooke, have received the contracts for steel work of St. Martha's Convent at Antigonish. D. R. Morrison & Sons are the general contractors.

Halifax Shipbuilding.—Between 1,400 and 1,500 persons are employed at Halifax Shipyards. "Canadian Mariner" is being taken on her trial trip this week. This vessel has a gross tonnage of 5,400, with 8,100 deadweight carrying capacity. The shipbuilders will be able to deliver the freighter to the Government very soon. "Canadian Explorer," a sister ship, will probably be launched about December 17.

Locating in Kitchener.—The American Ironing Machine Company, Chicago, will establish a Canadian branch of their business in Kitchener. Already an agreement for the lease of the worsted spinning factory has been completed, and the company will commence installing the machinery the first of March, with operations commencing April first, 1921. Between 40 and 50 men will be employed in the new concern at the beginning of operations.

Fire at Orillia.—The buildings, plant and equipment of the Electric Foundries, Ltd., at Orillia, were destroyed by fire. The concern was electrically operated, smelting being done with an electric furnace of 1,500 K.V.A. capacity. Ferrosilicon and pig iron were the products, and the foundry was being operated continuously day and night. The loss will be from $25,000 to $40,000, depending upon the condition of transformers and other electrical equipment after the fire. The plant was insured. The cause of the fire is unknown, but it may have originated from electric current which enters the building at 22,000 volts. The fire spread so rapidly that the workmen had barely time to get out with their lives. The Canada Castings, Ltd., which is operated in an adjoining building, was undamaged.

Auxiliary Power Plant.—The Oakvillle town council are again considering the possibility of adding an auxiliary power plant to the present one in the pumping station. During the sleet and ice storm some weeks ago, the power supplied by the Dominion Power & Transmission Lines went off.

Use Vancouver Ore.—Vancouver Island ore will be melted in a Seattle plant that is being constructed by Rothbert Process Steel Company at a cost of over $300,000. The company will produce carbon and high-speed steel and the plant will have a capacity of fifty tons a day. Convenience to supplies of all materials essential for manufacture of high-speed steel as well as electric power prompted the organization to locate its plant at Seattle. Large deposits of magnetite iron ore in Chelan county, Vancouver Island, are owned by the Rothbert organization. Dr. Rothbert experimented for eight years and for the last three years produced steel on a small scale by his new process. The chief economy obtained, he claims, is by the production of high grade steel from the ore through a single operation, eliminating the pig iron stage of production. Heats are turned out in four hours. Dr. Rothbert claims that titanium, which is considered a barrier to the smelting of magnetite ore, is accountable by his process for the superior qualities of his product, and he asserts he can produce by electric methods in competition with Eastern mills.



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STEEL OR CAST-IRON BODY
BUILT FOR HEAVY DUTY



All Screws Are Reversible

SCREWS are made of the best grade steel. Both ends are broached and are heat treated after machining. They are reversible, so that either end may be used, are large enough in diameter to stand the torsional strains applied by operator when setting up his work. They are made to give the best service—and may be depended upon to stand up under the hardest usage.

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Engineers • Manufacturers
BRANTFORD, CANADA

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Machine Tools
FOR SHIPBUILDERS & IRON & STEEL WORKS
BERTRAMS LIMITED
SCIENNES EDINBURGH

BLACK DIAMOND OVENS

OVENS

Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.

Brantford Oven & Rack Co. Ltd.
Brantford, Canada

PATENTS

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The old established firm. Patents everywhere. Head office, Royal Bank Bldg., Toronto. Ottawa office, 5 Elgin St. Offices throughout Canada. Booklet Free.

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Steel Tubing
for all purposes

Electric and Oxy-Acetylene Welded
Also
Butt Seam Tubing

Hot or cold rolled, in sizes ⅜ to 2 inches outside diameter, from 16 to 22-gauge. Also equipped for bending 16-gauge or lighter, any shape or radius. We furnish any shape — Rounds, Squares, Hexagons, Ovals and Special Shapes to customers' specifications.

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233 Dufferin St. TORONTO, ONT.

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for HEAT—
"OILGAS"
FURNACES

Whatever the process, if it requires *Heat* we can supply an *OILGAS* furnace to handle the work with the highest efficiency, safety and economy. We are experts in the economical combustion of liquid fuels. Let us investigate your heating problems.

Enquiries cheerfully answered

General Combustion Co.
of Canada, Limited
619-623 New Birks Bldg., Montreal

Classified Opportunities

AGENCY OPPORTUNITIES

WE ARE FREQUENTLY ASKED TO SECURE representatives for manufacturers in Canada, Great Britain and the United States. From time to time we shall publish particulars regarding agencies available and correspondence is invited. If the information has not been previously supplied please give particulars regarding experience, sales organization, territory, etc.

AMERICAN METALLURGICAL ENGINEERS and manufacturers of case-hardening compounds are anxious to be represented in Canada by responsible, aggressive party. Correspondence invited which will be treated as confidential. Box 736A, Canadian Machinery.

MANUFACTURER OF SAND MIXERS WISHes to secure aggressive representation in Canada. Box 733A, Canadian Machinery.

HIGH SPEED STEEL MANUFACTURER wants Canadian representation. Box 732A, Canadian Machinery.

AMERICAN MANUFACTURER OF CORE compounds, etc., wants Canadian agency connection. Box 731A, Canadian Machinery.

AMERICAN FIRM MANUFACTURING PATented process case hardening specialty wants the services of party capable of building up sales in Canada. Box 706F, Canadian Machinery.

HELP WANTED

WE WANT TO INTEREST SUCCESSFUL TRAvellers, at present covering Northern and Eastern Ontario with mechanical supplies, in a proposition offering unlimited possibilities capable of development into a main line. Box 735, Canadian Machinery. (c24m)

SALESMEN WANTED

Must be thoroughly familiar with the Foundry and Coal Mining Trade. Box 719 F, Canadian Machinery.

General Superintendent Wanted for James Smart Plant, Brockville

Energetic, experienced man possessing executive and mechanical ability, strong personality and knowledge of Plant construction, to co-ordinate and direct Assistant Superintendents in charge of Grey Iron Foundry, Machine, Woodworking, Hammer and Axe, Lawn Mower, Pump, General Hardware and kindred Departments. Give in first letter full particulars regarding age, experience, salary desired, etc. All replies treated confidentially. Address, Assistant General Manager, Canada Foundries & Forgings Limited, James Smart Plant, Brockville.

(c25m)

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MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W. H. Sumbling Machinery Co., Toronto. (ctfm)

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WANTED—18" DOUBLE LEATHER BELTING, about 62 ft. Box 738, Canadian Machinery. (c27m)

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MONEL METAL — FIFTY-FIVE BARS, ASsorted sizes. Will sacrifice. Canada Forge Plant, Welland, Ont. (c27m)

ONE 24-IN. DIA. x 48-IN. STROKE SIMPLE horizontal side crank Corliss steam engine, with 20-ft. x 25-in. flywheel and outboard bearings, made by Wood, Bolton, Eng.; one Northey jet condenser, 10-in. steam inlet, 8-in. water inlet, and 8-in. outlet; one London Machine Tool Co., 24-in. x 24-in. metal planer, single head, 6-ft. table, power cross feed, hand vertical feed and countershaft. Apply The Nova Scotia Underwear Co., Ltd., Windsor, N.S. (c24m)

Concrete Machinery—latest improved type, made in Canada. Mixers, Hoists, Crushers, Rolls, Brick, Block, Tile and Sewer Pipe Machines, second-hand Gas Engines, Contractor's and Builder's Plant. We specialize in supplying complete plants for manufacturing cement products, brick, block, tile and pipe.

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1 — 24" Smith & Mills Shaper.
3 — 3' x 36' Jones & Lamson Turret Lathes.
1 — 18" x 8' Stevens Lathe, D.B.G.
2 — 18" x 8' Mueller Lathes, D.B.G., Q.C.G.
1 — 26" x 12' C.M.C. Lathe. D.B.G., Q.C.G.
1 — 32" x 24' Engine Lathe.
5 Gross 10" Victor Power Hack Saw Blades. Price—List less 25%.

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Machinists, special machinery made to order, repairs, cylinder grinding, pistons, rings and wrist pins. Satisfaction guaranteed. (c2m)

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(c5m)

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Manufacturers of
Steel Plate Work, Tanks
BOILER REPAIRS
Oxy-Acetylene Cutting and Welding.
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(c2sm)

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TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

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WANTED — WOODWORKING MACHINERY and mining machinery, machine tools, boilers, and steam pumps, alternating or direct current motors. Contractors' equipment. Apply Box 737F, Canadian Machinery.

IF YOU HAVE IRON-WORKING OR WOODworking machines for sale, or idle machine shop equipment, call or write Canada's largest dealers in new and used machinery. H. W. Petrie Limited, Toronto, Ont. (F)

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Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

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Will handle medium Specialty Line — Manufacturing and Selling

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For a high grade Piston Packing amongst mill and steamer supply houses in all the principal centres. Sold at a reasonable price, allowing for a good margin of profit to the dealer.

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Until the advent of the Audit Bureau of Circulations, advertisers sowed their business seed in a vast but fallow field. Some of it grew and returned a fair harvest—much of it was cast upon barren ground and was lost. There was no standardized method of determining the fertiity of a publication's field. Experimenting was expensive.

The A. B. C. has eliminated the barren spots of circulation. Planting an advertising crop is no longer an experiment. Advertisers know the field through audit reports. They know whether it is fertile ground and sow their seed accordingly.

Canadian Machinery circulation has been audited by the A. B. C. Advertisements placed in this publication are seeds well sown.

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42" Pond Car Wheel Lathe, Motor Drive
36" x 22' Bridgeford, g. h. Motor Drive.
36 x 16' Sidney, D. B. G., Q. C., new
27 x 14' Sidney, D. B. G., Q. C., new
14" to 21" x 6' to 12' Sidney
13" to 15" x 6' to 12" Carrol-Jamieson

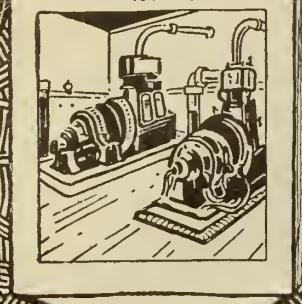
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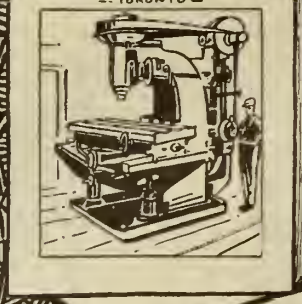
40 x 40 x 10' Powell, 2H Planer
24 x 24 x 5' Pease 1H Planer
16 x 16 x 42" Walter, 1H Planer
14" Steptoe Shaper
16" x 20" x 24" Steptoe, B.G., new Shaper
7" Rhodes, Precision, new Shaper
16" Used Smith-Mills Shaper
16" Used Kelley, B. G. Shaper
No. 4 Brown and Sharpe, Plain Miller
No. 24 Osterlein, Plain Miller
No. 22 Garvin, Vertical Miller
No. 2 M. U. Garvin, Universal, new Miller
No. 1 Dow, Plain, new Miller
No. 3 Burk Hand Miller
No. 3½ Fox Hand Miller
6' Western Universal Radial Drill
3' Mueller, Plain, Radial Drill
42" Canedy-Otto Plain, new Drill
3 Spindle Barnes, B.G. Drill
No. 1 Caplin Keyseater
No. 4 Caplin Keyseater
No. 0 Baker Keyseater
10" x 36" Norton Plain Grinder

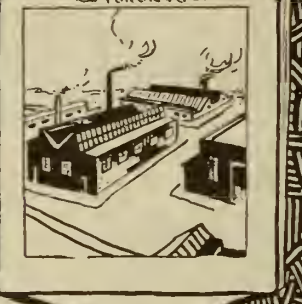
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Serves the power plant engineer—Steam, Electric Refrigeration, Hydraulic.

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Covers the metal working field—serving shop executives, purchasing agents and owners. First-class mechanical paper and market paper combined.

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Monthly—$2.00 per year.
A paper for the foundry owner, superintendent and foreman. Claimed by its readers to be unexcelled.

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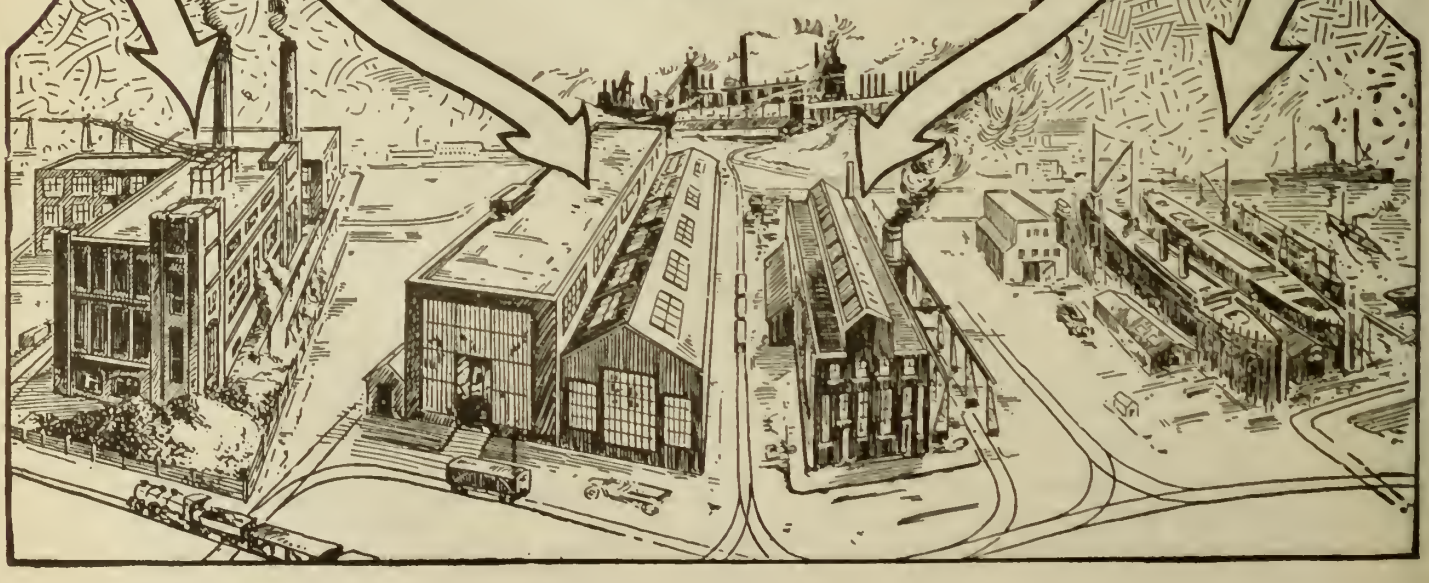
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Hoyt Metal Co., Ltd., Toronto.
Magnolia Metal Co., Montreal.
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Morrow Screw & Nut Co., John, Ingersoll
Williams Mchy Co., A. R., Toronto, Ont.

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Chapman Double Ball Bearing Company, Toronto.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Marshall Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
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Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.

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Madison Mfg. Co., Madison, Wis.
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Petrie, Ltd., H. W., Toronto.
Summer & Co., New York, N.Y.
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BEARINGS, ROLLER
Lyman Tube & Supply Co. Montreal, Que.

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Graton & Knight Mfg., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

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Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
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Jones & Glasseo, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
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Renold of Canada, Ltd., Montreal.
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Can. Link-Belt Co., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Federal Engineering Co., Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Graton & Knight Mfg., Worcesteh, Mass.
International Mchy. Spls., Ltd., Montreal
Jones & Glassco, Montreal, Que.
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Gutta Percha & Rubber, Ltd., Toronto.

BELTING, HAIR
Sumner & Co., New York, N.Y.

BELTING, LEATHER
Can. Graton & Knight Mfg. Co., Montreal
Gutta Percha & Rubber, Ltd., Toronto, Canada.

BELTING, RUBBER
International Mchy. Spls. Ltd., Montreal.
Quaker City Rubber Co., Philadelphia, Pa.

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Gutta Percha & Rubber, Ltd., Toronto.

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Sumner & Co., New York, N.Y.

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Bertarm & Sons Co., John, Dundas.
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Can. Blower & Forge Co., Kitchener.
Dom. Steel Product Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

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Jardine, A. B., & Co., Hespeler, Ont.
National Mach. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
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Marshall, Son & Bunney, Toronto.
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Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que
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William Hamilton Co., Peterboro, Ont.

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Petrie, Ltd., H. W., Toronto.

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BOILERS
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MacGovern & Co., Montreal, Que.

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Garlock-Walker Machinery Co., Toronto.
Landis Machine Co., Waynesboro, Pa.
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Rice Lewis & Son, Toronto, Ont.
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Petrie, Ltd., H. W., Toronto.

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London Bolt & Hinge Wks., London, Ont.
Morrow Screw & Nut Co., John, Ingersoll
National Acme Co., Cleveland, Ohio.
Rice, Lewis & Son, Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton
Wilkinson & Kompass, Hamilton, Ont.
Williams & Co., J. H., Brooklyn, N.Y

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BOLTS, STAY
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, SPRING SHAKLE
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Morrow Screw & Nut Co., John, Ingersoll

BOLTS, PATCH
Morrow Screw & Nut Co., John, Ingersoll

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Garlock-Walker Machinery Co., Toronto.
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
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Garlock-Walker Machinery Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Herbert, Ltd., Alfred, Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Hoefer Mfg. Co., Freesport, Ill.
Landis Tool Co., Waynesboro, Pa.
Oliver Machinery Co., Grand Rapids, Mich.
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Canada Metal Co., Toronto.

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MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

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Franklin Mfg. Co., Syracuse, N.Y.
Can. Metal Co., Toronto, Ont.

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Franklin Mfg. Co., Syracuse, N.Y.
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Dominion Foundries & Steel Ltd., Hamilton, Ont.

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Alexander Fleck Ltd., Ottawa.
Tallman Brass & Metal Co., Hamilton

CASTINGS, BENCH LEG
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie
Dominion Steel Products Company, Ltd., Brantford, Ont.
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt, Ont.

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Bernard Industrial Co., A., Fortierville, Q.
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Can. Elec. Castings Co., Ltd., Orilla, Ont.
Dominion Steel Products Company, Ltd., Brantford, Ont.
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Roht., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
Interantional Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.
McFarlane Engineering Ltd., G. W., Paris, Ont.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

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Dom. Foundries & Steel, Hamilton, Ont.
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International Malleable Iron Co., Guelph

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CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

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Morrow Screw & Nut Co., J., Ingersoll.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

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Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machinery Co., Toronto.
Lyman Tube & Supply Co., Montreal, Q.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

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Renold of Canada, Ltd., Montreal.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

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Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
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CHAINS, FOR ELEVATORS AND CONVEYORS
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Petrie, Ltd., H. W., Toronto.
Renold of Canada, Ltd., Montreal.
Williams Mchy. Co., A. R., Toronto, Ont.

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Can. Link-Belt Co., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
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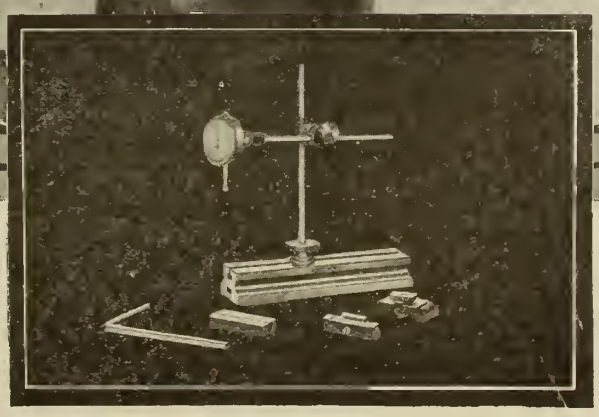
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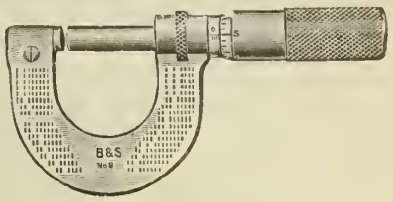
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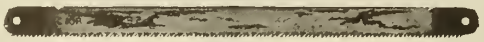


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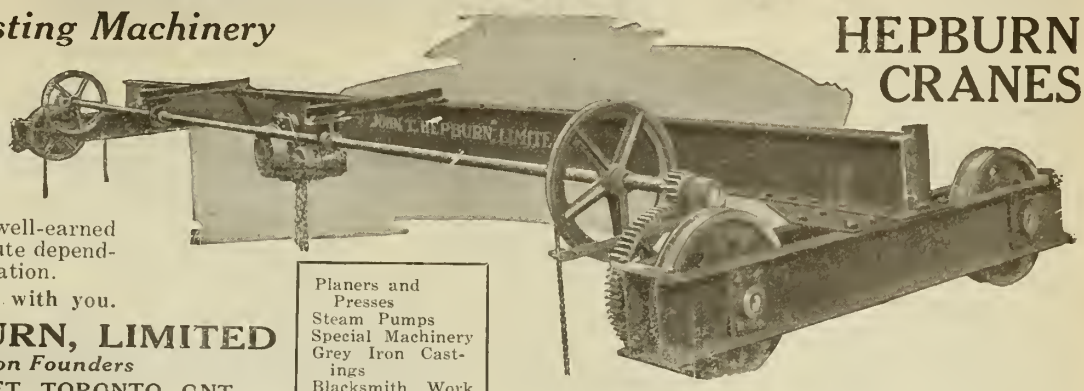
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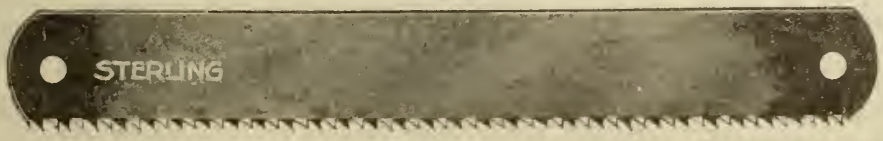
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Garlock-Walker Machinery Co., Toronto.
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Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
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Garlock-Walker Machy. Co., Toronto.
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United Hammer Co., Boston, Mass.

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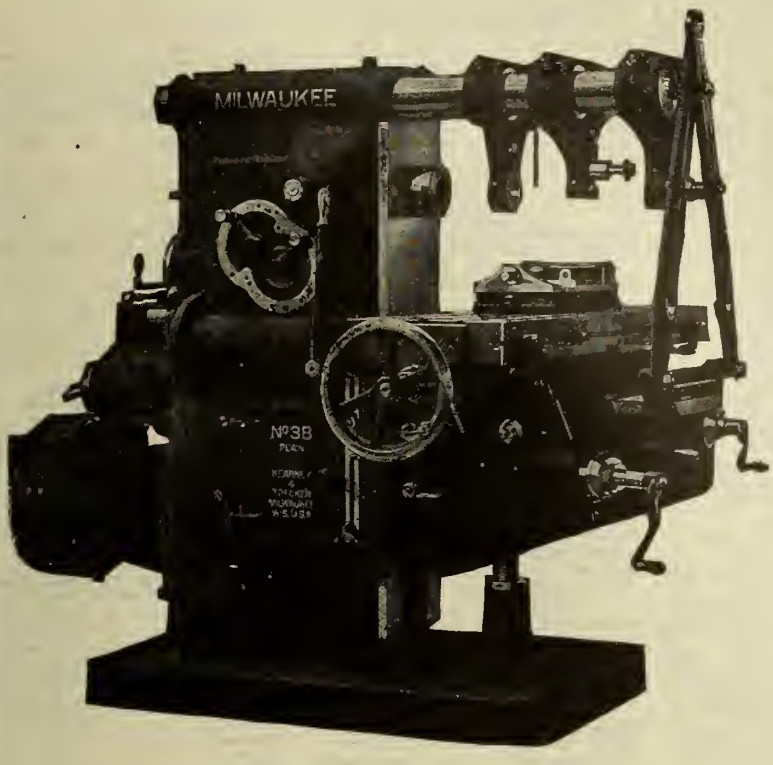
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Herbert Ltd., Alfred, Toronto, Ont.

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Hoyt Metal Co., Toronto, Ont.

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LINK BELTING
See Belting, Chain.

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Dennis Wire & Iron Works, London, Ont

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Swan & Finch, Inc., New York.

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Ford-Smith Mach. Co., Hamilton, Ont.
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Hendey Mach. Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
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Strelinger, Chas. A. Co., Windsor, Ont.

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Standard Equipment & Tool Wks., Montreal, P.Q.

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Petrie, Ltd., H. W., Toronto.
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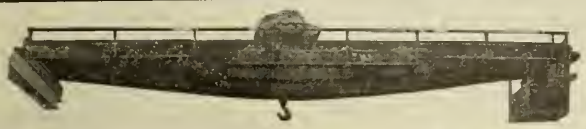
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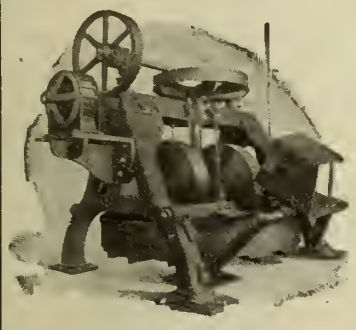


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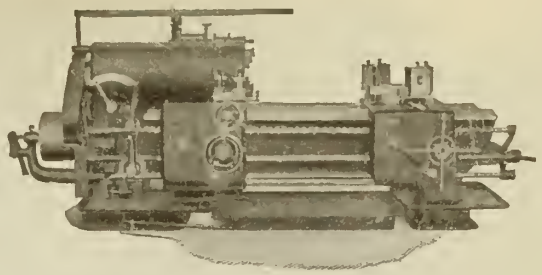
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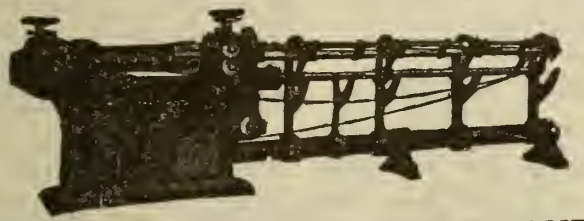
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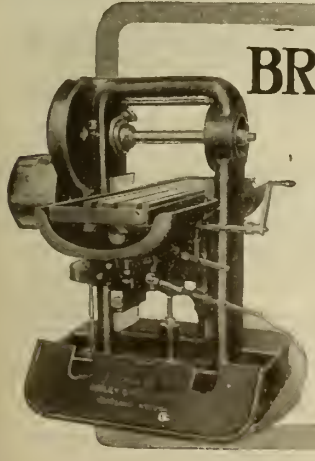
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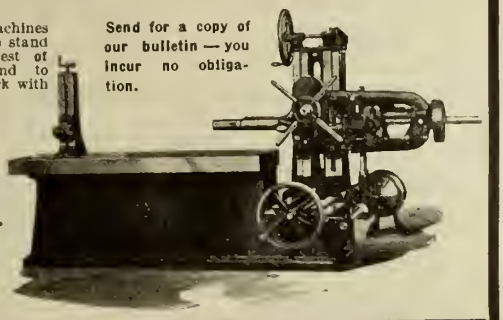
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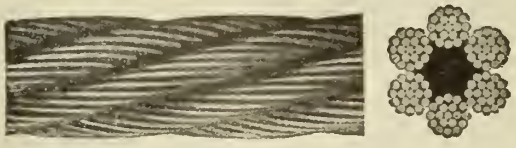
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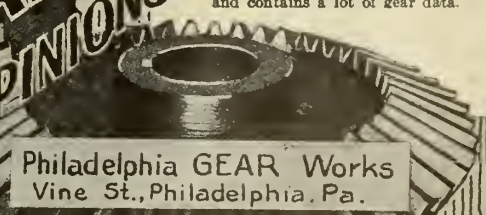
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HENDEY

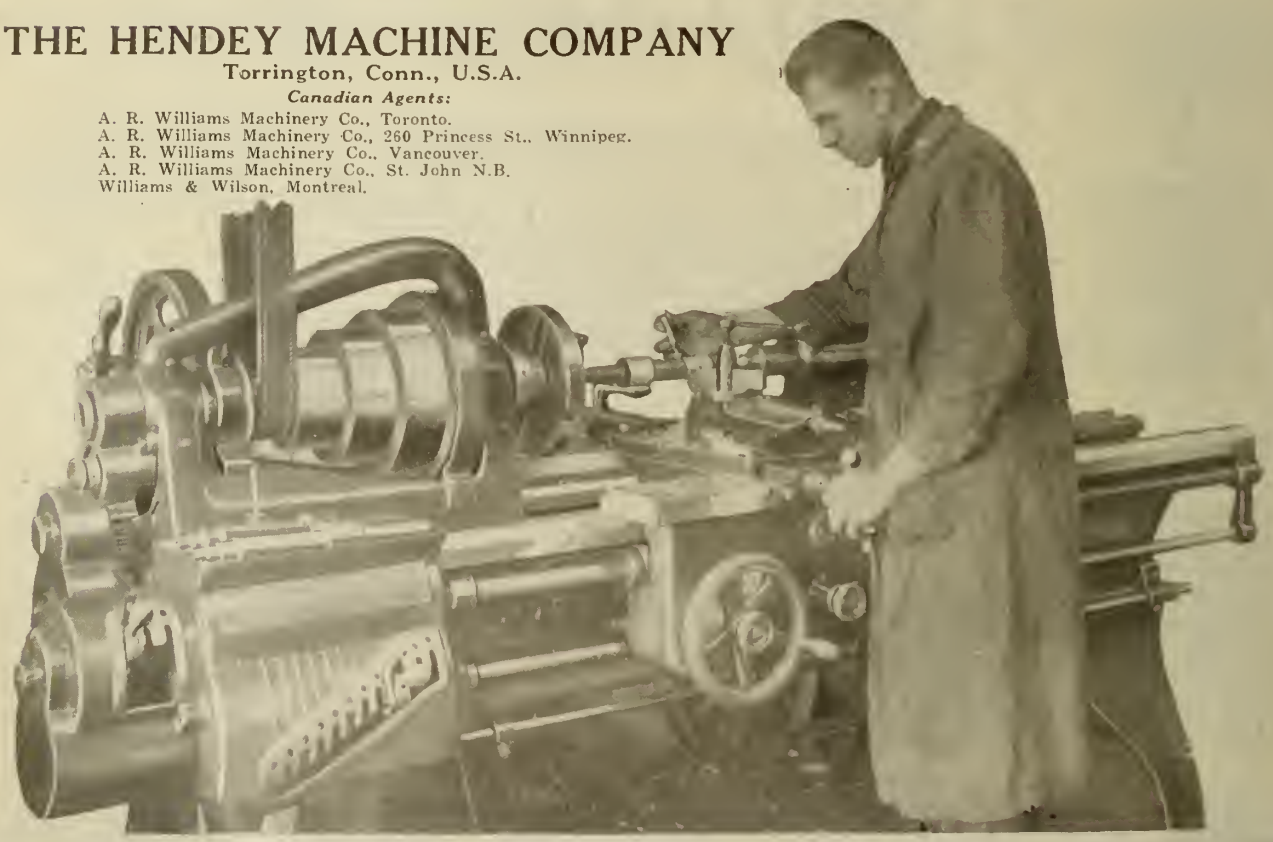
"Splendid for the toolroom, very efficient——"

Those firms which have experienced difficulty in procuring a lathe which will give satisfaction within close limits of accuracy on tough materials, have yet to test the Hendey! The Fellows Gear Shaper Co. are using the Hendey below for turning down Chrome Nickel Steel Indexing Worms. The operations include turning, facing and threading. Rough size of stock is 2¼ inches, large diameter 2.156, small diameter .625 and limits of accuracy of .001 inches are required. A production of three pieces a day is maintained by the Hendey lathe.

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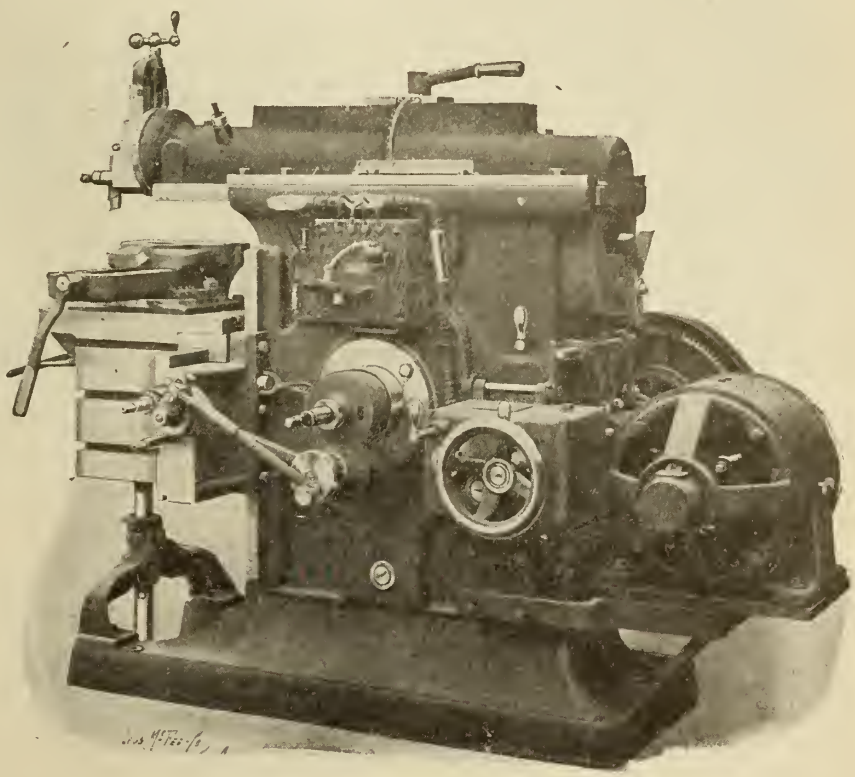
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Permit Changing the Stroke Without Stopping the Machine

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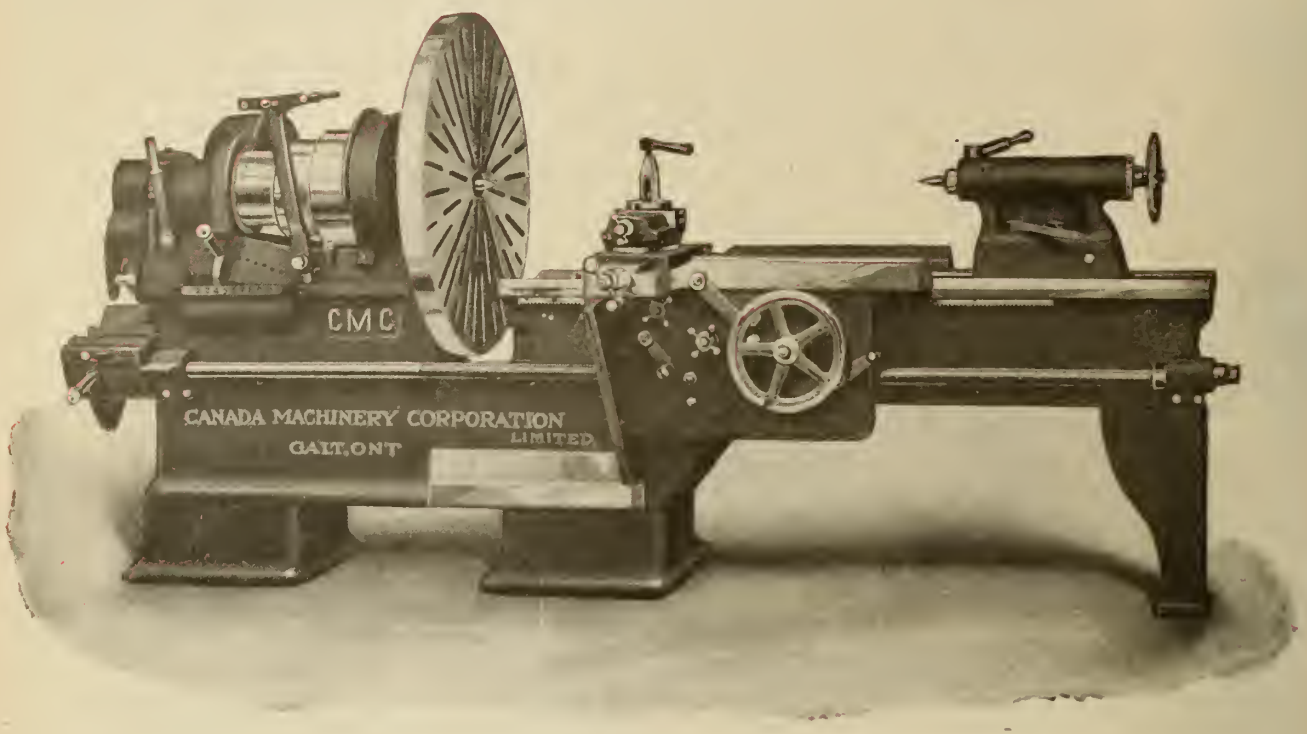
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18" Gap Lathe



Strength Production Safety

Why not investigate? This Gap Lathe is a strong, accurate, high speed tool. For evidence, notice the construction of the bed, the width of the cones on the headstock insuring a powerful drive and that the design permits the large face plate and thin work to swing without removal of the gap plate. The safety of the operator is provided for by guards over all gears, belt shifter on the headstock and corresponding shifter on the countershaft.

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CANADIAN MACHINERY AND MANUFACTURING NEWS

A weekly newspaper covering in a practical manner the mechanical power, foundry and allied fields.
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Vol. XXIV. No. 26 Publication Office, Toronto, December 23, 1920. Subscription Price $4.00 per year.

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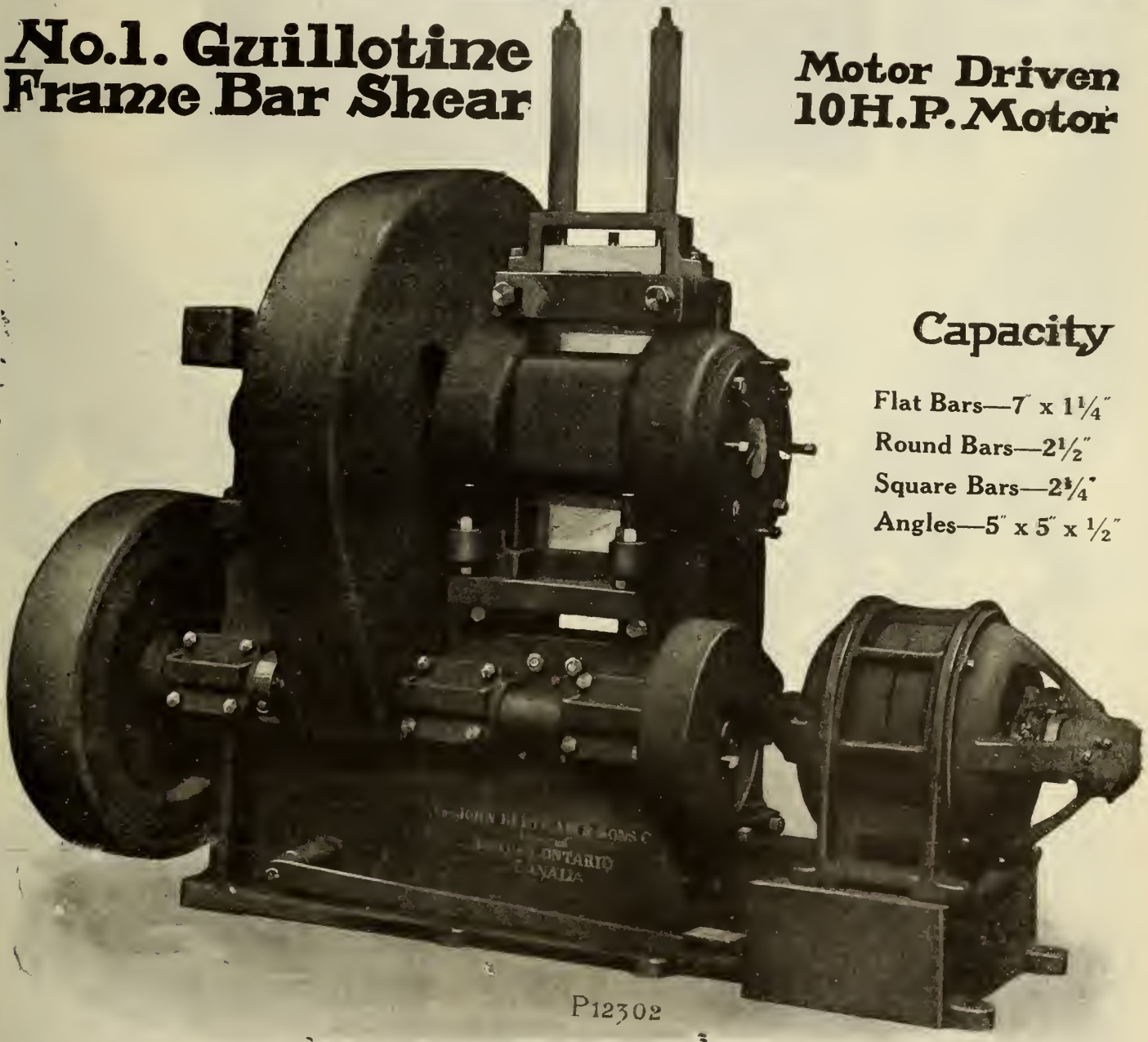
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The BERTRAM Page

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Canadian Machinery and Manufacturing News, December 23rd, 1920. Vol. 24, No. 26. Published weekly at 143-153 University Avenue, Toronto, Canada. Subscription price in Canada, $4; United States, $4.50. Entered as second-class matter at the Post Office Department, Ottawa, Canada. Entered as second-class matter July 1, 1912, at the Post Office Department at Buffalo under the Act of March 3rd, 1879.



"The first one lasted two weeks, finishing 1800 battery jars every day."

The Nick o' Time

(The Purchasing Agent's Story)

"Talk about the nick o' time!" said Mr. Gummere, Purchasing Agent of the Luzerne Rubber Company, of Trenton, N. J. "It's something less than a second—but you remember it all your life.

"Bill Smith," he went on, "is the operator on our big Peerless surfacing machine. He's an old hand at finishing—keen on his work. Well, sir, you should have seen Bill's face when he came into my office one noon two or three months ago. He'd had trouble with his abrasive belts—lots of trouble. Seems they were going bad on him, wearing out after only two or three days' use.

" 'One make's just as bad as the other lately,' Bill growled. 'For the love of Mike, Mr. Gummere, can't you get me *some* make of belt that'll stand up to the work? I'm a good workman and I want good tools.' And then he walked out of the office, still steaming.

"Then came the 'nick.' I'd hardly turned to my list of abrasive manufacturers when in came the office-boy with the card of a salesman for Manning Abrasive Company. I had him come right in and nearly fell on his neck. Before he could start talking, I'd given him an order. And the best of it was that Bill Smith was tickled pink with the goods.

"Old Father Time made up that salesman's itinerary."

(The Salesman's Story)

" . . . . . and I'd hardly sent in my card before they pushed me in after it. Gummere, the Purchasing Agent, gave me an order without shaking hands—before I could even tell him about our line."

(The Operator's Story)

" . . . . . so I went in to see Mr. Gummere, our Purchasing Agent. I was sore about the abrasive belts he'd been buying, and I guess I let him know it.

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WILT

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We take this opportunity of extending thanks for the business we have been favored with during the present year and are happy in the thought that the quality, price, and service we are rendering will merit a repetition of these numerous favors.

It is our sincere hope that the New Year will bring relief from the trials and tribulations which inevitably follow such a world-wide upheaval.

May the New Year favor us with a quick return to normal conditions.

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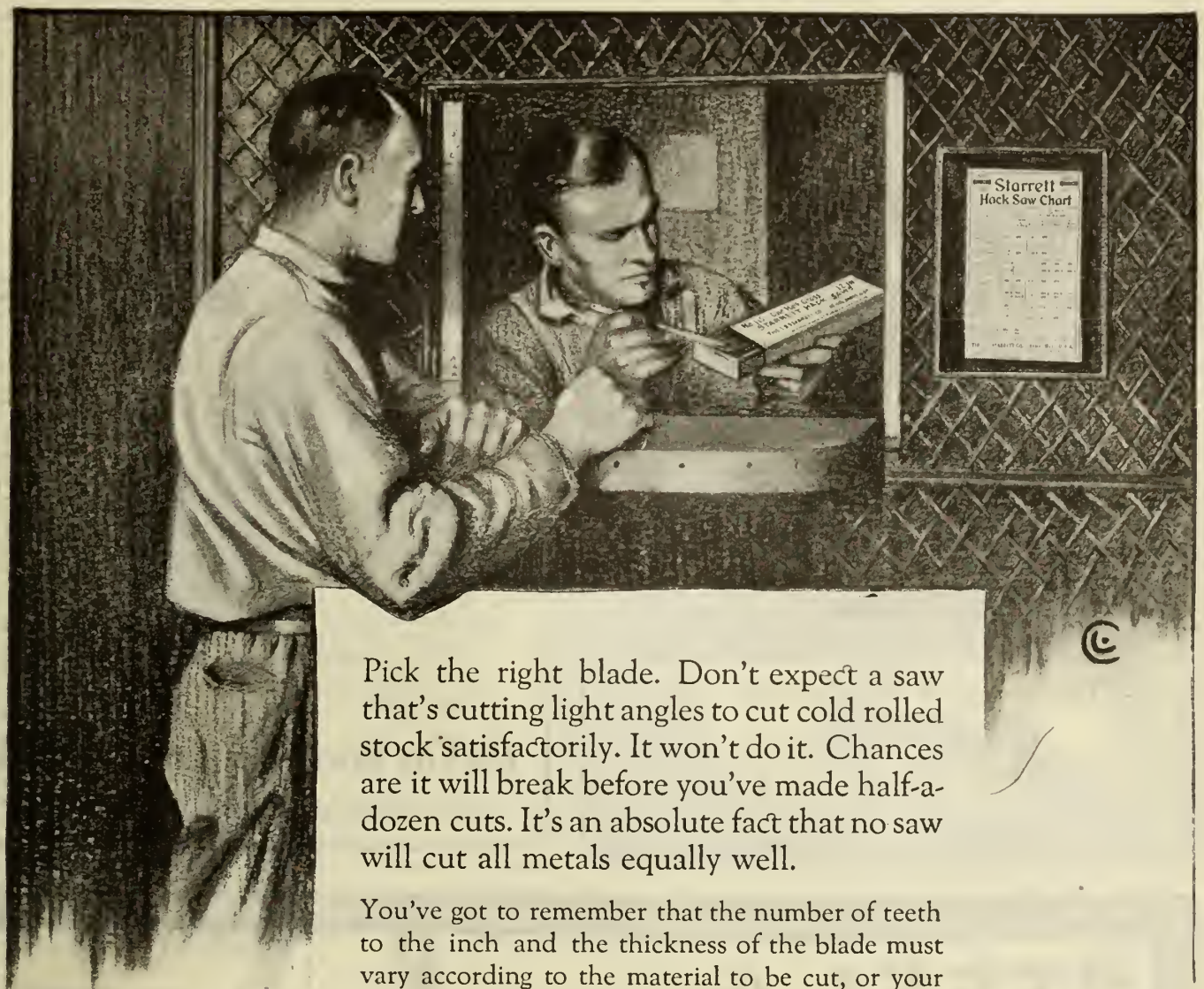
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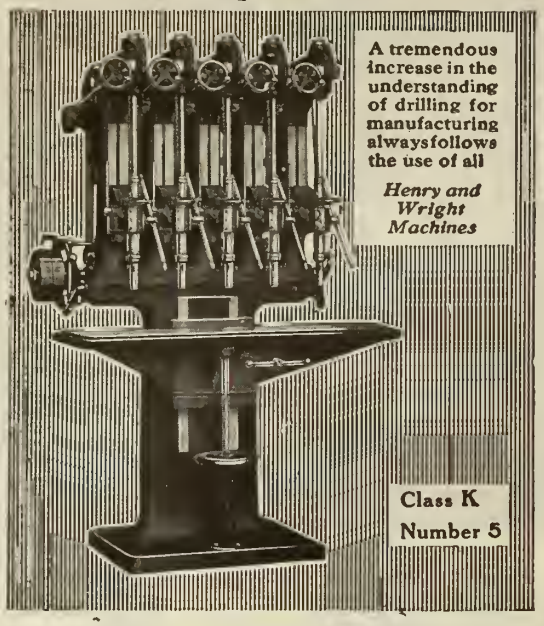
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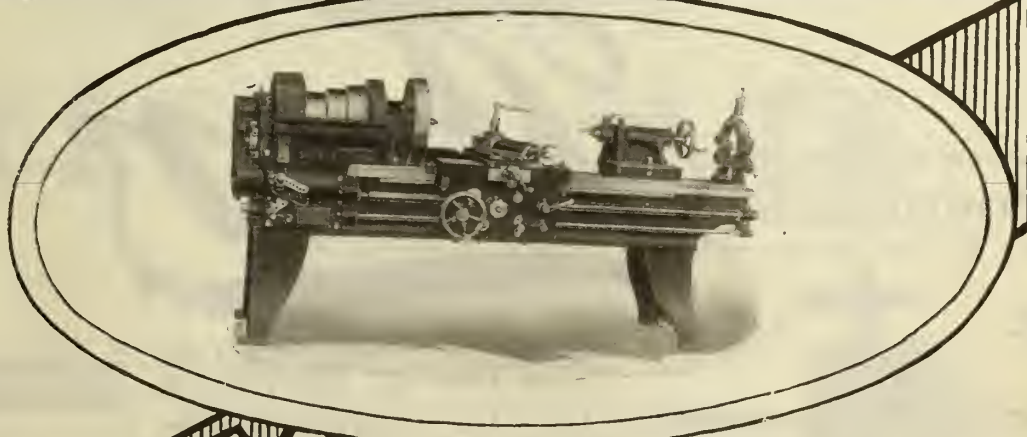
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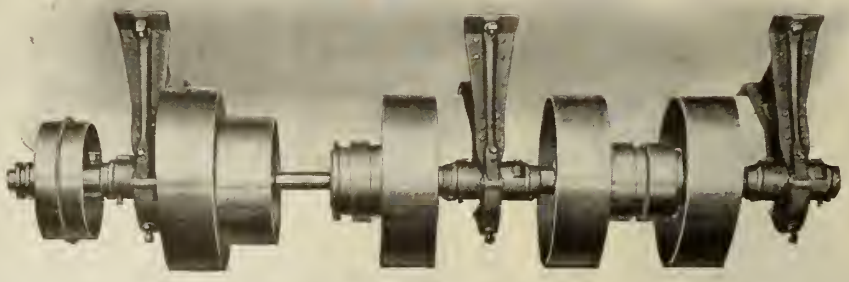
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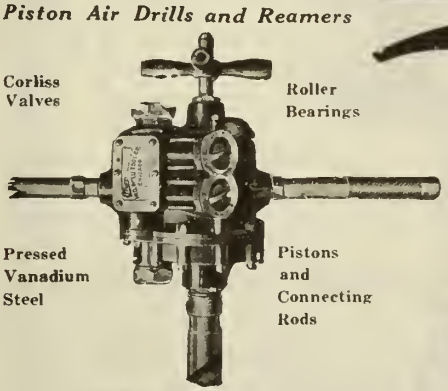
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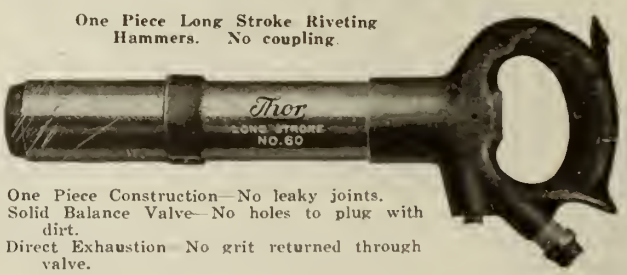
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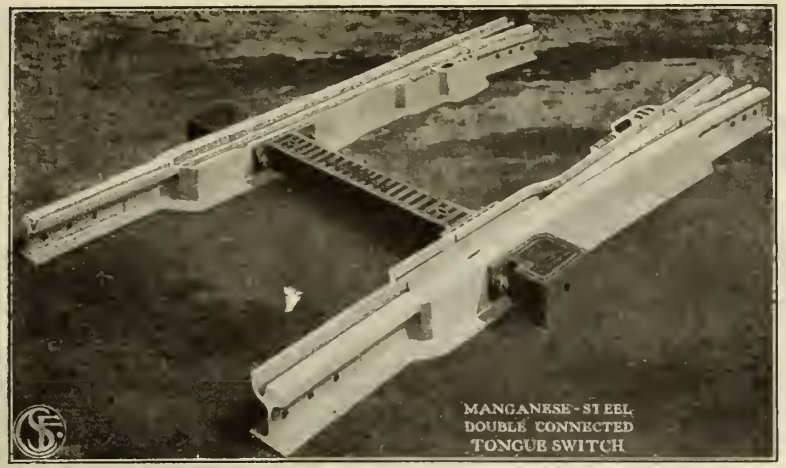
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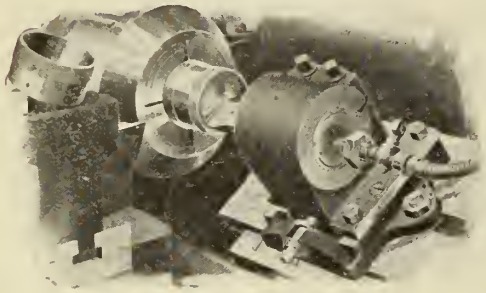
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Dominion Foundries & Steel, Limited

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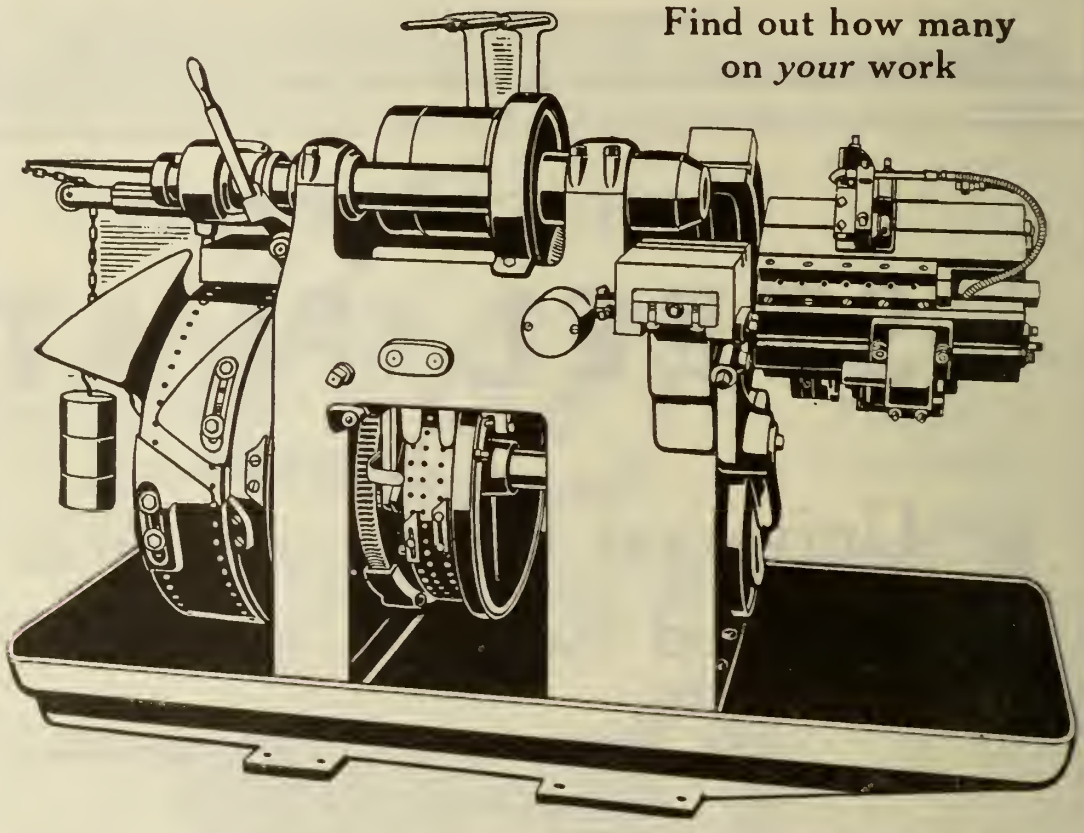


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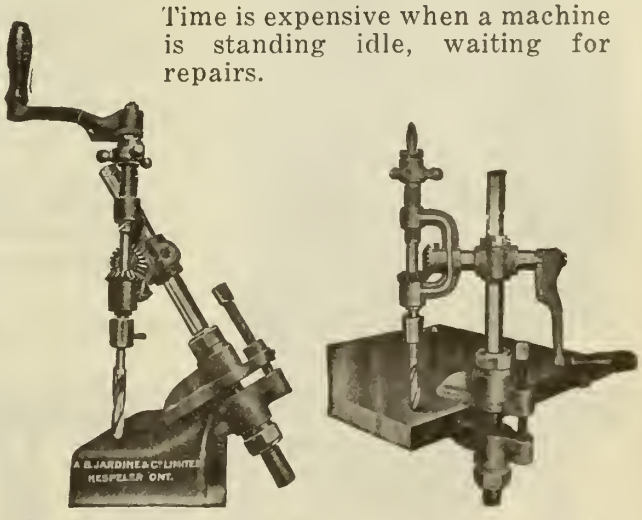
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Tool Steel
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1856
Frankford, Phila.
New York Office 217 Broadway

RALPH B. NORTON, AGENT
124 Craig St. W.
Montreal, Canada

Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.

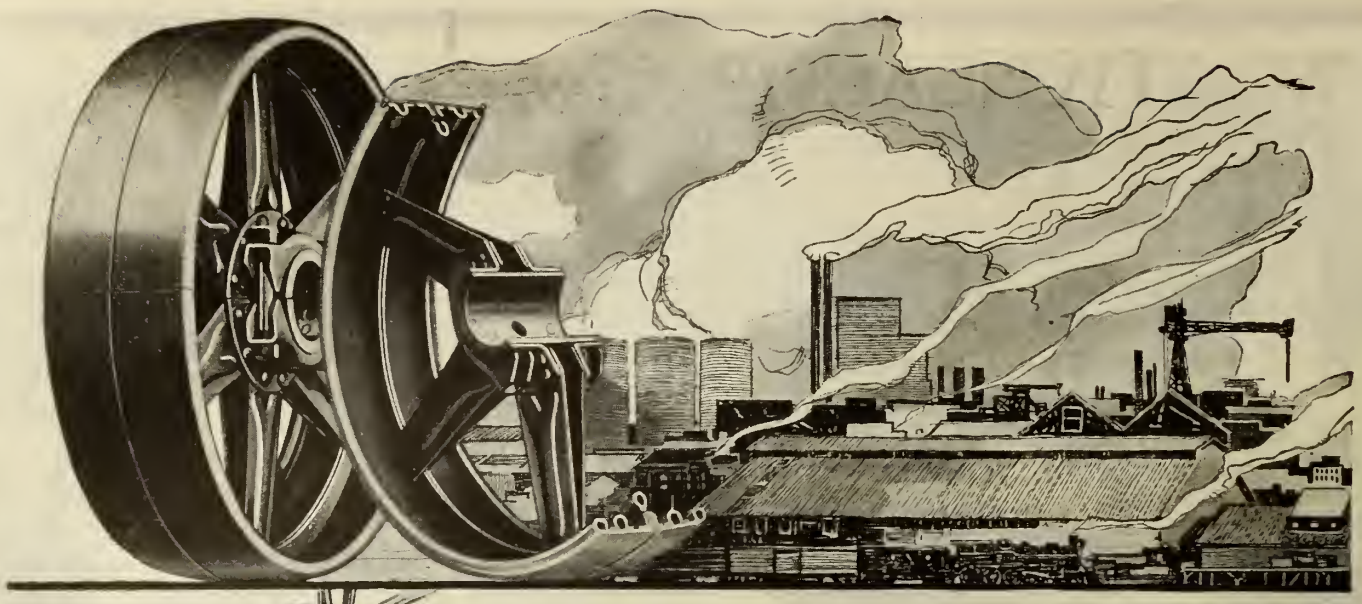


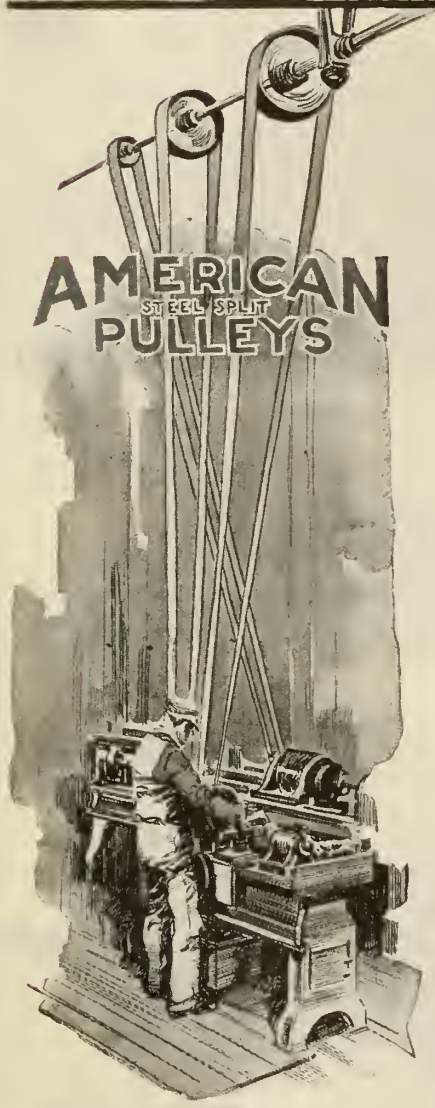
On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited
HESPELER, ONTARIO

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NOW—of all times

when economical production is needed, elimination of waste is vital

NECESSITY compels elimination of waste—is forcing all of us to higher achievements in efficiency.

We like to think that the "American" Pulley is one of the means American power users are finding ready at hand to meet these needs.

Every ounce of power today must do useful work: "American" Pulleys are so light that they greatly reduce dead weight on shaft. They offer less air resistance. They reduce belt slip.

Every workman today must be producing during all the hours of his day. Long shut-downs for repairs and replacements must be eliminated. Here again "American" Pulleys help. Guaranteed to perform double belt duty and capable of enduring higher speeds, they assure longer and unbroken service. When shutdowns for replacements or new installations are necessary, "Americans" make them but momentary, for they are divided and therefore can be applied or removed without stripping or disturbing the shaft in any way.

You will better understand why more than 5,000,000 of these remarkable pulleys have been installed if you will let us send you the book, "Getting Maximum Pulley Efficiency." Will you send us the address?

For name and address of nearest Dealer, see Donnelley's Red Book. On file at all leading libraries, national banks and hotels.

The American Pulley Co.

Philadelphia, Pa.



The AMERICAN PULLEY

"A wheel with a broad rim transmitting power from or imparting power to machinery, or changing the direction of motion by means of a flat belt."



>FLINT-RIM<
Sprocket Wheels
for
Durability

"Combination" Link-Belt Chain
for
Elevators and Conveyors

Link-Belt Malleable Iron Buckets

LINK-BELT

Chains—Wheels—Buckets

for elevating and conveying materials of every character have earned a reputation for durability and efficient service.

>FLINT-RIM< wheels have hard, smooth bearing surfaces for contact with the chain links, thus insuring both wheels and chain from undue wear. They last twice as long as ordinary cast-iron wheels.

"C" Class Link-Belt Chain is superior because of its joint construction which insures a long life of efficient service.

Link-Belt buckets are made by experienced molders who specialize on this work. They are remarkably free from blemishes and other casting deficiencies, have clean edges and sharp corners; gates are ground off and they are thoroughly oiled before shipment.

Demand this >——< mark for genuine Link-Belt Products.

CANADIAN LINK-BELT CO., LTD.

TORONTO - - - - - WELLINGTON AND PETER STS.
MONTREAL - - - - - - 10 ST. MICHAEL'S LANE

LINK-BELT

Elevators and Conveyors

We Also Make

- ☐ Chain and Sprockets
- ☐ Silent Chain Drives
- ☐ Truck and Tractor Chains
- ☐ Electric Hoists
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- ☐ Portable Loaders
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- ☐ Coal Pockets

Write for Catalogs
Place X in Square

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STARS WIN *3 to 0*
over nearest competitors

The report produced above is typical of the way Star Hack Saws prove their superiority when a careful comparison is made of either hard or power blades.

B. Mfg. Co. P.——Pa. 8/19/20

"Bought some Star hand blades and reported F & L blades very poor. Had been using X blade* and claimed it was much better than Star. I asked man to make cuts with Star, tried blades on angle iron and blade cut fine. He tried to find a hard piece and finally found one he said X blade would not cut. I made three cuts with one Star blade and they admitted best work they ever saw. Also tried power blade for them with fine success. Gave F & L order for Star hand blades and will use Star on power as soon as needed."

**the blade we recognize as being our nearest competitor*

Over and over again our service men have been able to show plants how to save 1-3 in metal cutting costs by using Star saws and Star methods—often in plants thoroughly satisfied with previous results. If such a considerable saving can be effected in your plant, of course you are vitally interested in knowing it.

There are the best of reasons for the superior cutting ability of Star Hack Saws. We have found a way of using more tungsten, which gives us a harder, faster cutting blade. The saw teeth have a better clearance and cutting edges that keep right on cutting even after the teeth are well worn down. That is why you can crowd on more weight and speed with a Star blade and speed up your metal-cutting production beyond the ordinary limits.

Star Saws are now sold by the factory which has made them since 1883. For service information and direct orders, address our plant at Middletown, N.Y.

If you order of jobbers or dealers, be sure you get "Star."

CLEMSON BROS. INC.
MIDDLETOWN, N.Y.

Canadian Office and Warehouse:

304 Imperial Office Building, Hamilton, Ont.

AUTOMATICS

For milling parts automatically there is nothing to compare with the P. & J. method.



The operator keeps two tables going at the same time, thereby eliminating machine idleness.

Send your blueprints along and we will show you how.

Bulletin No. 40

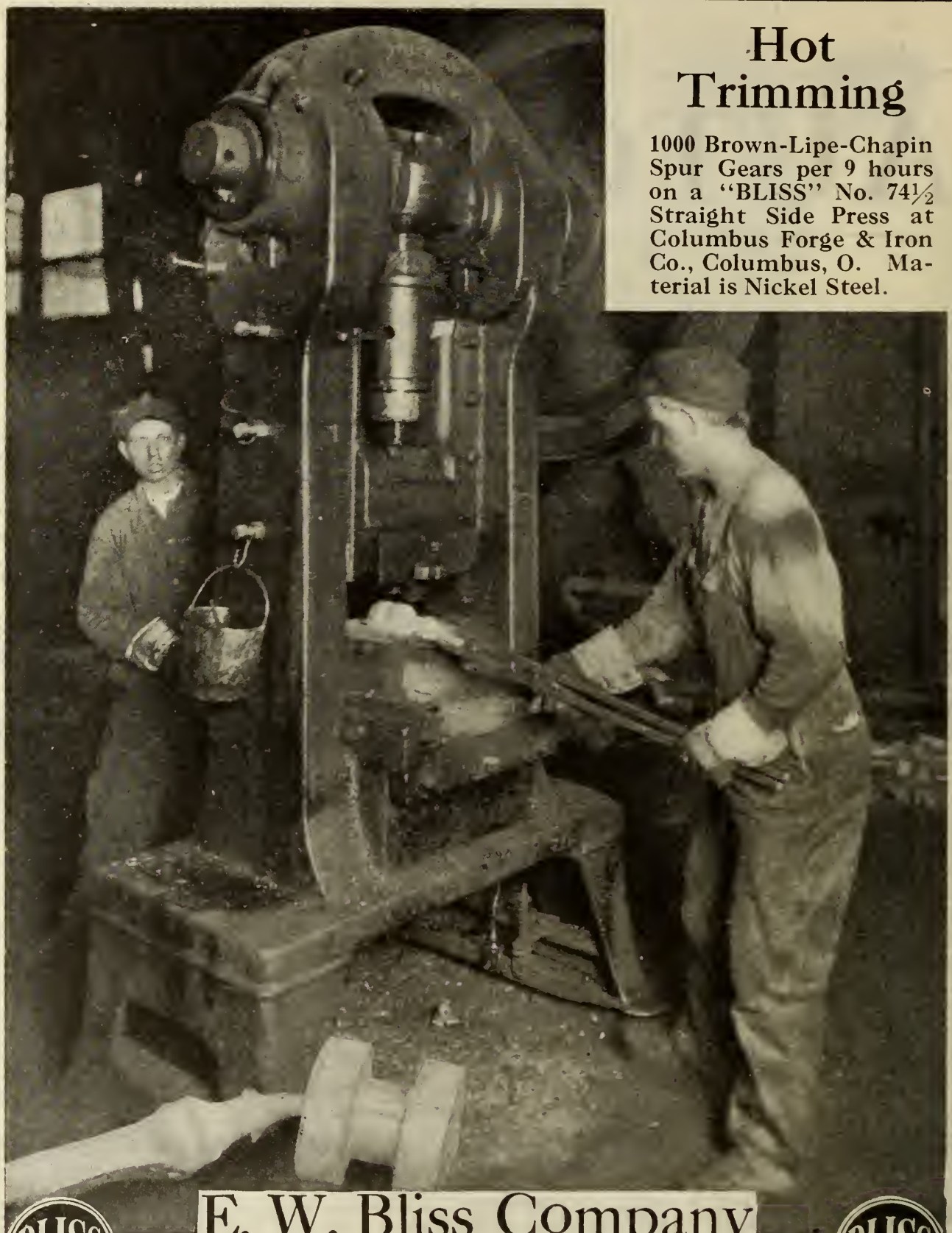
Canadian Offices: POTTER & JOHNSTON MACHINE CO.

ROELOFSON MACHINE & TOOL CO., LIMITED

Head Office and Show Rooms:

11 Wellington Street East, TORONTO, CANADA

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Hot Trimming

1000 Brown-Lipe-Chapin Spur Gears per 9 hours on a "BLISS" No. 74½ Straight Side Press at Columbus Forge & Iron Co., Columbus, O. Material is Nickel Steel.

BLISS 1857

E. W. Bliss Company

BLISS 1920

Main Offices: BROOKLYN, N. Y., U. S. A.

American Factories: BROOKLYN, N. Y. *and* HASTINGS, MICH.

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CINCINNATI, Union Trust Bldg. BUFFALO, Marine Bank Bldg. ST. LOUIS, Boatmen's Bank Bldg. PITTSBURGH, Keenan Bldg.

No. 116

FOREIGN SALES OFFICES and FACTORIES

LONDON, ENGLAND, Pocock Street, Blackfriars Road, S. E. PARIS, FRANCE, 100 Boulevard Victor-Hugo, St. Ouen

MINISTRY OF MUNITIONS G R

The Disposal Board

Have

STOCKS

Lying in the United Kingdom and

AVAILABLE FOR EXPORT

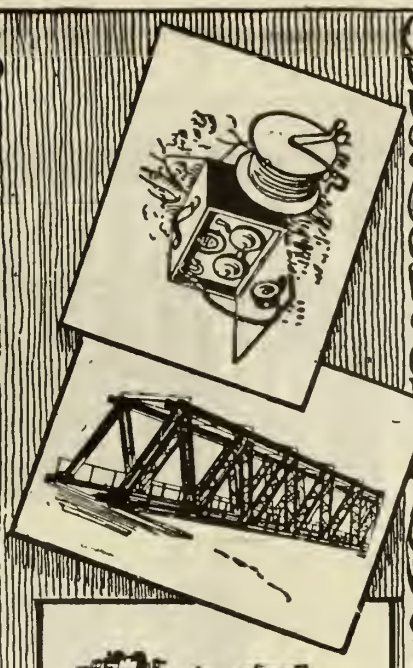
of

ENGINEERING STORES

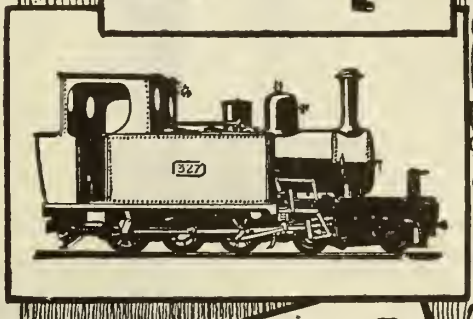
Ferrous and Non-Ferrous Metals
Plant and Machinery
Steam Engines and Boilers
Factory Store
Machine Tools
Railway Material
Contractors' Stores
Electrical Instruments and Machinery
Medical Stores
Chemicals and Explosives
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Aircraft
Furniture
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Motor Boats, etc., etc.
Boots and Leather Equipment, etc.

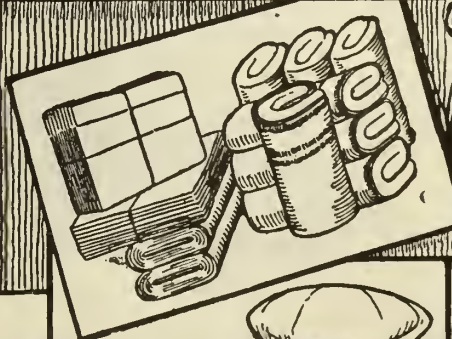
Buyers should instruct their representatives in the United Kingdom to communicate with The Secretary, Disposal Board, Ministry of Munitions, Caxton House, Tothill Street, London, S.W. 1.

Cable Address :
"DISPEXPORT, MUNORGIZE, LONDON."

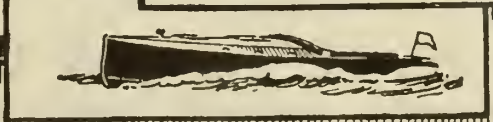


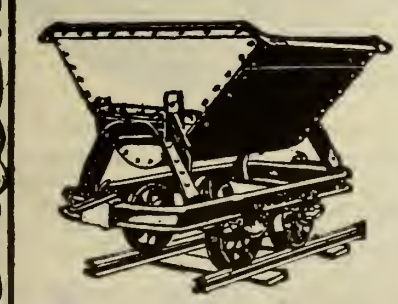


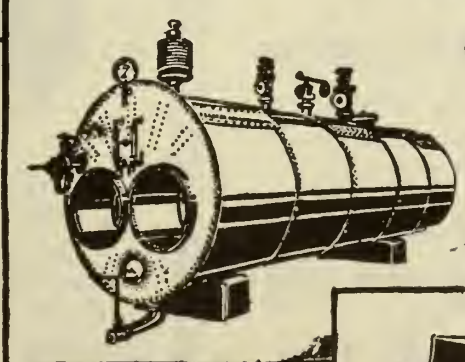












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BUILT IN FOURTEEN SIZES

By the aid of a very efficient plant and organization, we manufacture these machines in large numbers by mass production.

Prices and Deliveries are Right

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CABLES—ATHENIAN, SEDIST, LONDON

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Has an Advantage Over Other Grinders

There is some outstanding feature of all La Salle Grinding Machines that lends it exceptional productive ability.

The American Drill Grinder is especially adaptable for grinding twist, flat and three-lipped drills, because it has automatic lip rest and caliper jaw device, which assures proper clearance on all sizes of drills automatically. Send for descriptive matter covering our entire line of grinding machinery.



American Drill Grinder For Wet or Dry Drill Grinding 1/8" to 2¼". Also 1/8" to 3½" dia.

LA SALLE TOOL CO.

La Salle, Illinois, U.S.A.

Represented in Canada by

A. R. Williams Machinery Co., Ltd.

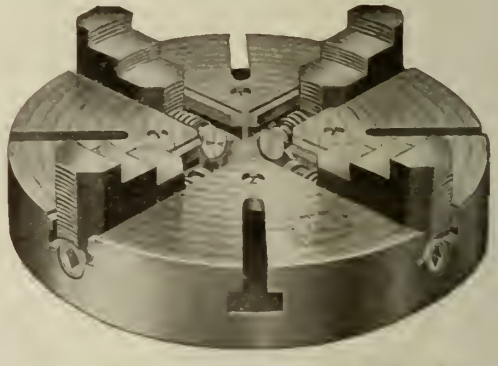
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INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



THE UNION STEEL BODY CHUCKS

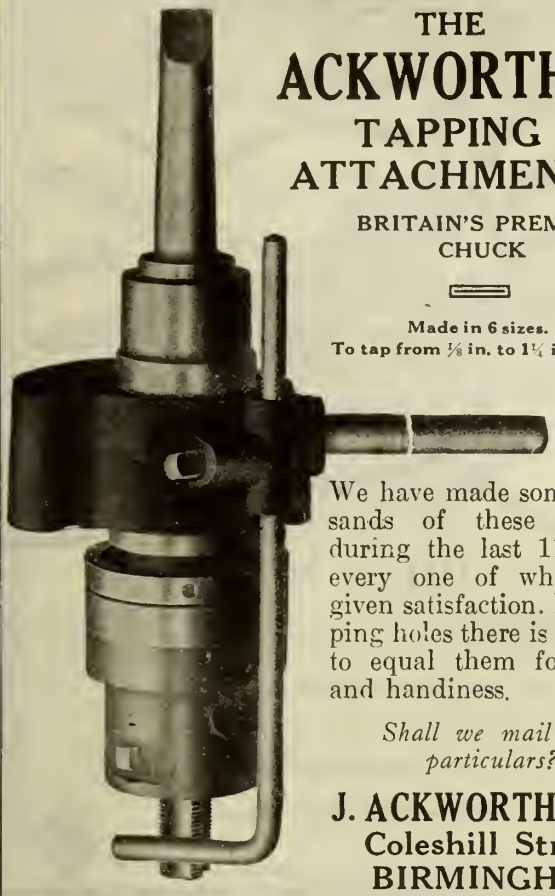
are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

UNION MANUFACTURING COMPANY

New Britain, Conn.

New York Office: 26 Cortlandt Street

Makers of a complete line of chucks



THE
ACKWORTHIE
TAPPING ATTACHMENT.

BRITAIN'S PREMIER CHUCK

Made in 6 sizes.
To tap from ⅛ in. to 1¼ in. Whit.

We have made some thousands of these Chucks during the last 11 years, every one of which has given satisfaction. For tapping holes there is nothing to equal them for speed and handiness.

Shall we mail you particulars?

J. ACKWORTHIE, Ltd.
Coleshill Street, BIRMINGHAM

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Manufacturers of EXTRUDED BRASS and BRONZE RODS and SECTIONS.

HOT BRASS and BRONZE STAMPINGS and PRESSINGS.

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CHILL CAST PHOSPHOR BRONZE BARS.

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BRASS ROD, STAMPINGS AND METAL MANUFACTURERS

ROTTON PARK STREET
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We shall also be pleased to quote for shipments direct from Birmingham, shipping in two weeks' time.

Sole Canadian Agents:
Thomas Moore & Son
224 Lemoine Street, Montreal

We excel in quantity production

THE MASTER METAL

STELLITE

Not steel—but its master

Here is an excellent example of the superiority of Stellite over high speed steel for fast cutting.

A lathe operator was able to turn to form twenty-six cast iron wheels in ten hours with a high speed steel tool. The following day a Stellite tool was substituted for the steel one, and the same operator was able to turn to form forty-nine wheels in ten hours. The high speed tool was ground twice for each wheel finished, making fifty-two times in all, while the Stellite tool was simply sharpened once at the end of the day.

We will gladly prove the value of Stellite to you by sending a demonstrator to show just what Stellite can accomplish under your shop conditions.

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Branch Warehouses:
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26 Abermarle Street, London, Eng.

THE MASTER METAL

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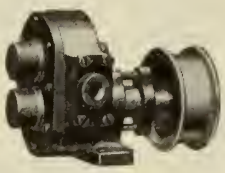
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Circulating Pumps

will deliver to the tools any coolant which does not contain grit. Large capacity, continuous non-pulsating stream. Slow speed—long life. When properly installed they will not lose their prime.

Our Bulletin 44 explains in detail.

Canadian Representatives:
A. R. WILLIAMS MACHINERY CO., TORONTO



TRAHERN PUMP DIVISION
Geo. D. Roper Corporation
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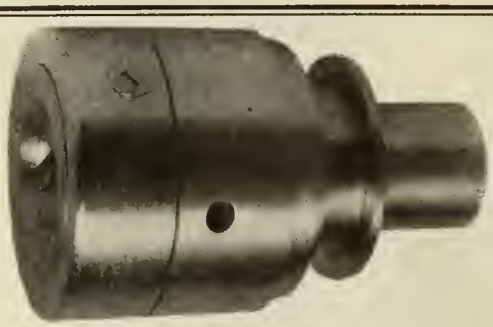
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Why not Save Time, Grinding Wheels and High Speed Steel by using Armstrong Tool Holders on Your Lathes and Planers?

Refuse Imitations and Substitutes.

Catalogue free.

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No. 2 TYPE "R" Hartness Automatic Die

WITH SHANK FOR REVOLVING SPINDLES

These dies are designed for use on either vertical or horizontal spindles. Die is re-locked by forward motion of sleeve, which may be actuated by a yoke working in the groove or by a fixed stop making contact with rear edge of sleeve at the return stroke. Die is unlocked in the usual manner by retarding its forward motion or by a fixed stop, making contact with the external tripping button shown on the face of the die. External tripping button is especially desirable in cutting very short threads as it relieves the thread of the strain incidental to unlocking by the pull-off device.

The diameter of the No. 2, Type R die is 3 3-16 in., and its length as shown is 3½ in.

The Die cuts both right and left-hand threads ½ in. to 1 in. in diameter, and from 10 to 40 threads per inch.

Shanks are varied to meet individual requirements.

A set of standard chasers in carbon steel is supplied gratis with each Die.

No tools of any kind need be used in changing chasers.

A chaser grinding jig is supplied gratis on Die orders if desired.

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(DIE DIVISION)

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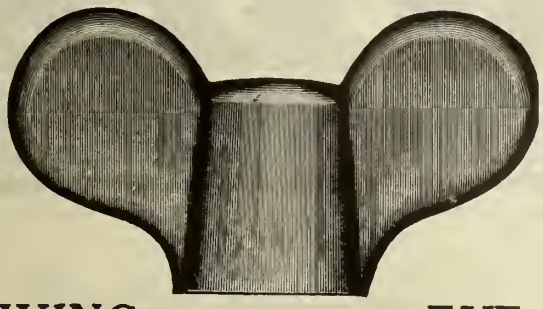
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American Agents for Dies and Chasers:
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CANADA FOUNDRIES & FORGINGS LIMITED

DROP FORGED STEEL



WING NUTS

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All Sizes

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Imperial Genuine

Made for extra heavy duty, such as Main Bearings on Turbine Generators, Calender Rolls in Pulp Mills, is specially adapted for Marine Engines.



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THE BABBITT METAL WITHOUT A FAULT

For Donkey Engines, Saw Carriages, Small Motors, Transmission Line Shafting and all steady heavy pressure duty.



Matchless

Suitable For Slow-Moving Bearings

THE CANADA METAL CO., LIMITED
TORONTO HAMILTON MONTREAL
WINNIPEG VANCOUVER

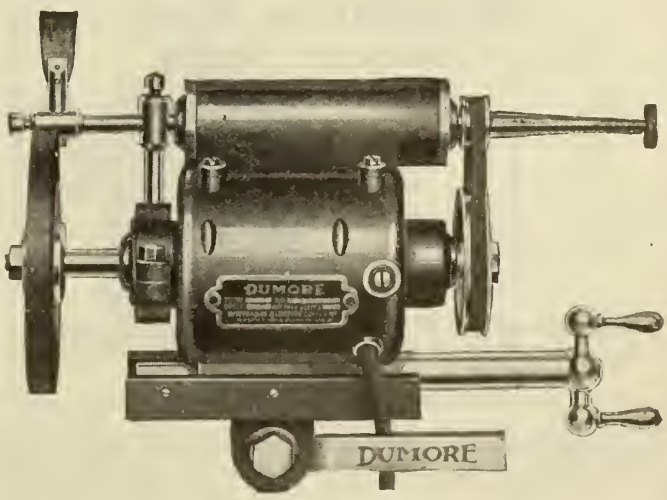
Quantity Production Makes for Economy—

Quantity Means Die-Castings

Many indeed are the firms which have found that the die-casting process is a sure means of boosting their production and lowering their costs.

Die-casting means a real saving to any manufacturer who requires a large number of duplicate parts. Die-cast parts are strong, accurate and uniform. Also, they require no machining. They come to you clean and smooth—already to assemble.

Investigate the possibilities of die-castings on your work. Write us to-day. We are the largest makers of die-castings in Canada.



Die-Casting Chat No. 39. Practically everybody knows of the Dumore Grinder, but how many know that all the bearings and casings of these machines are die-castings?

That die-castings can be used for a high quality tool such as the Dumore Grinder, with perfect satisfaction, illustrates just how meritorious the process is.

It will pay you to find out if die-castings can be made of any of the parts of your product.

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QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½ lb. to 5,000 lbs. each

THE WILLIAM KENNEDY & SONS,
LIMITED
OWEN SOUND, ONTARIO
ESTABLISHED 1860

STEEL CASTINGS

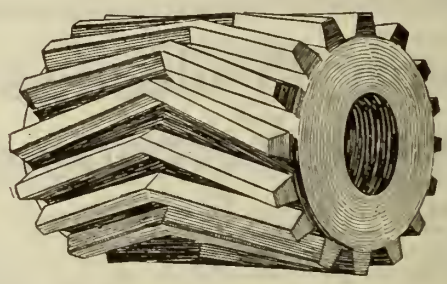
We shall be glad to supply, in addition to our General Catalogue, literature on
Steel Castings — Lithographed Ware
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Made by the Acid Electric process up to fifteen tons. Castings made by this process are free from blow holes, easy to machine, and superior in every way to ordinary Steel Castings.

Castings supplied for shipbuilding, cars, locomotives, all classes of machinery, etc.

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DAVIDSON

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Simonds Simonds

Hack Saw Blades That Reduce Cutting Cost

SIMONDS

For Machine or Hand Use. Hardness in the teeth for rapid cutting—Flexibility in the blade for long wear. They do not break when properly used.

SIMONDS CANADA SAW COMPANY, LIMITED

St. John, N.B. Montreal, Que. Vancouver, B.C.

Simonds Simonds

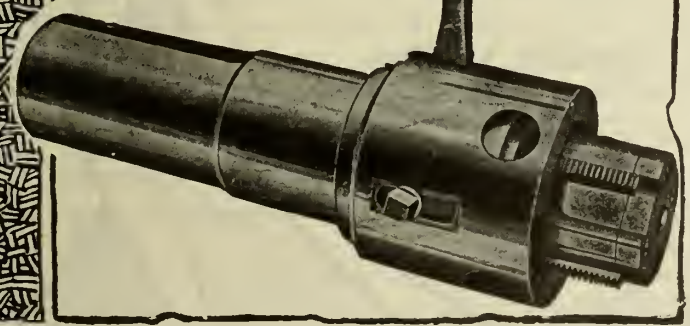
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"BOTH of these operations and half another — I'll show you later—completed in the time our old taps took to do one; that, I guess, is why we continue to use your Victor Collapsible Taps."

It was the often-heard story of time saved, of costs lowered, of all threads clean and smooth. And it was pleasant to hear.

Victor Tool Company
Waynesboro, Pa.
U.S.A.

Send For Estimates



DOMINION GRINDING WHEELS

Meet Modern Requirements



Every grinding job should have its particular kind of grinding wheel. There's a Dominion Wheel for every operation in your shop —a wheel made of suitable abrasives of exact grade and grain.

Dominion Wheels are **made in Canada** — no better wheels can be obtained anywhere. Put them to the test.

Dominion Abrasive Wheel Company, Ltd.
Mimico, Ontario



Rotary Continuous Heat-Treating Furnaces Used in Quantity Production of Pressed Steel Parts.

METALLURGISTS

The following advantages are secured by the Continuous Method of Heat-Treatment:

Bringing material up gradually to the final temperature.
Utilizing heat in spent gases to preheat material.
Exposing each piece to heat in same manner, to same temperature, for same length of time.
Uniformity not only of the individual piece but of the sections thereof as compared with the corresponding sections of other pieces.

DO THESE ADVANTAGES APPEAL TO YOU?

Write for Bulletin 217-T and learn whether the continuous method is adaptable to your product and manufacturing conditions.

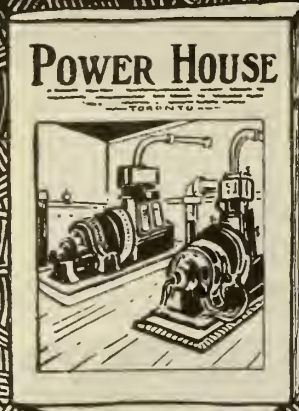
W. S. ROCKWELL COMPANY
Furnace Engineers and Contractors
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We make Industrial Heating Furnaces for Every Requirement
"FURNACE AND FUEL TO SUIT CONDITIONS."

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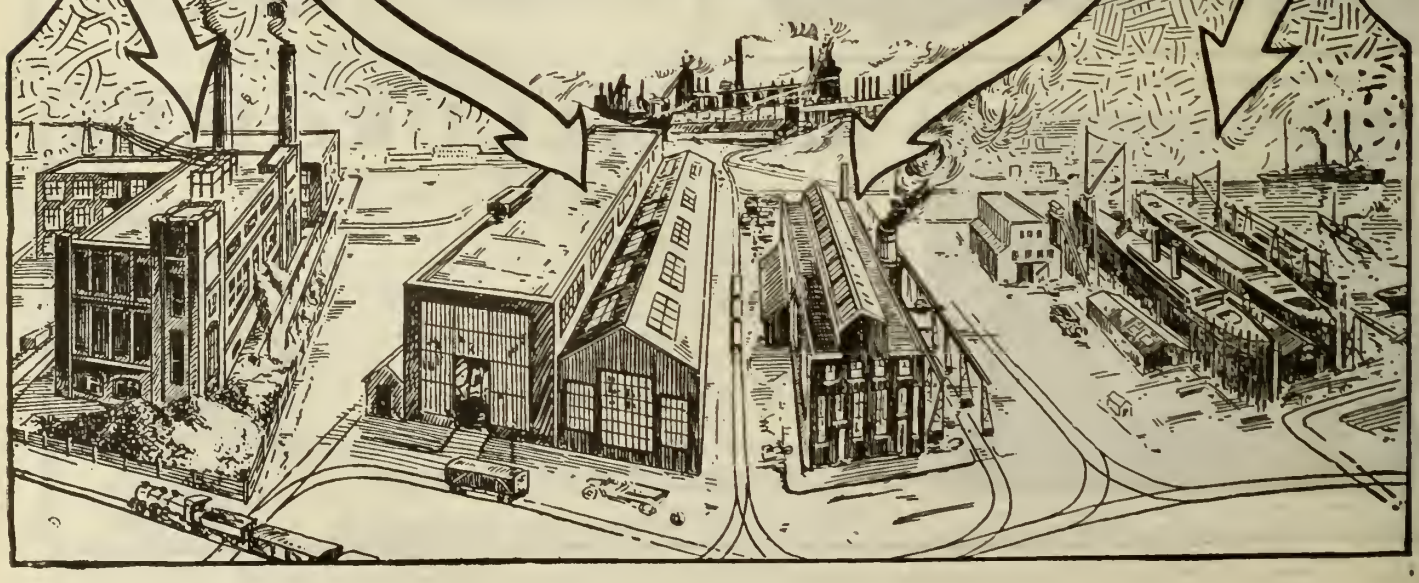
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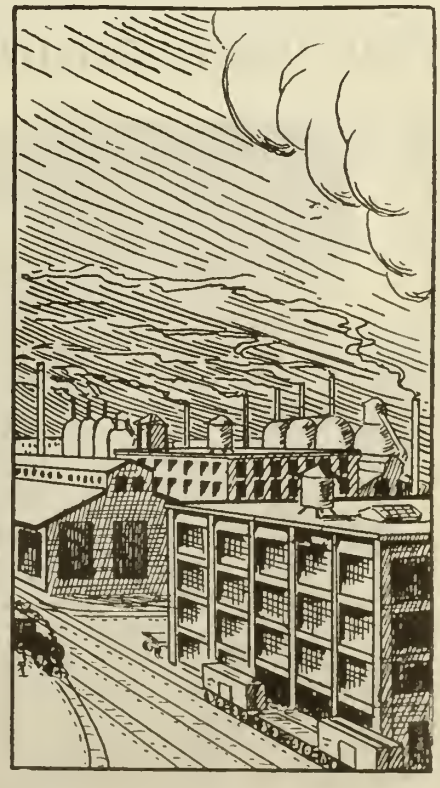


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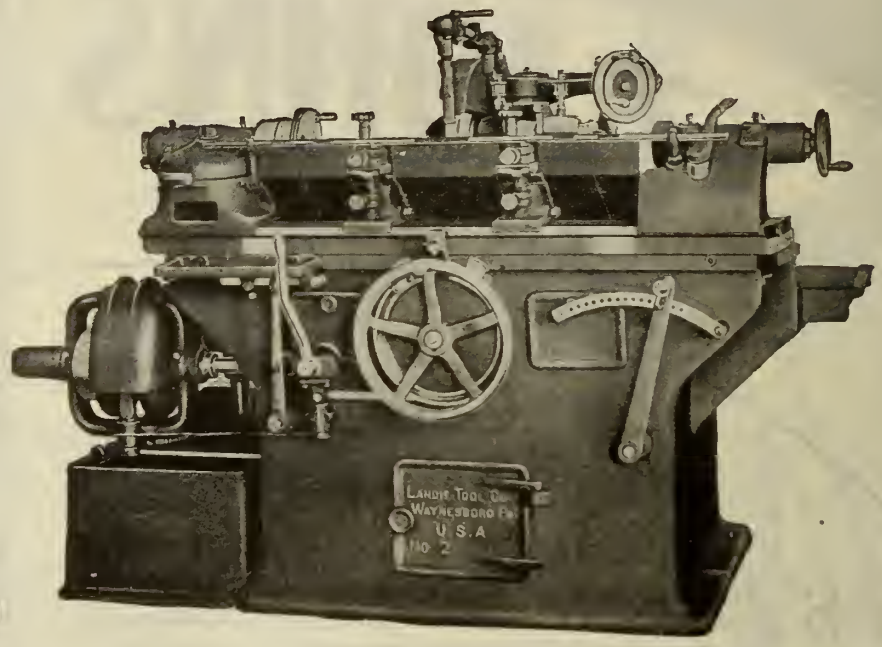
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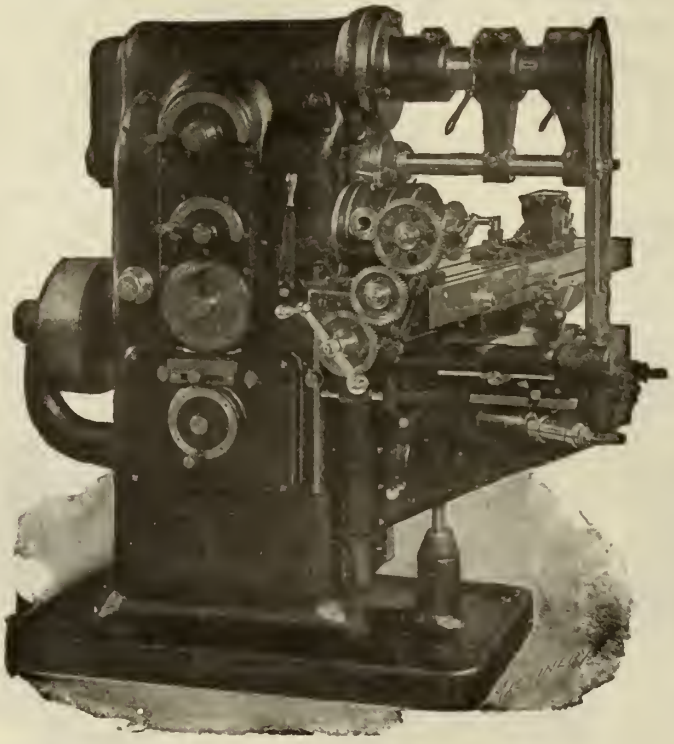
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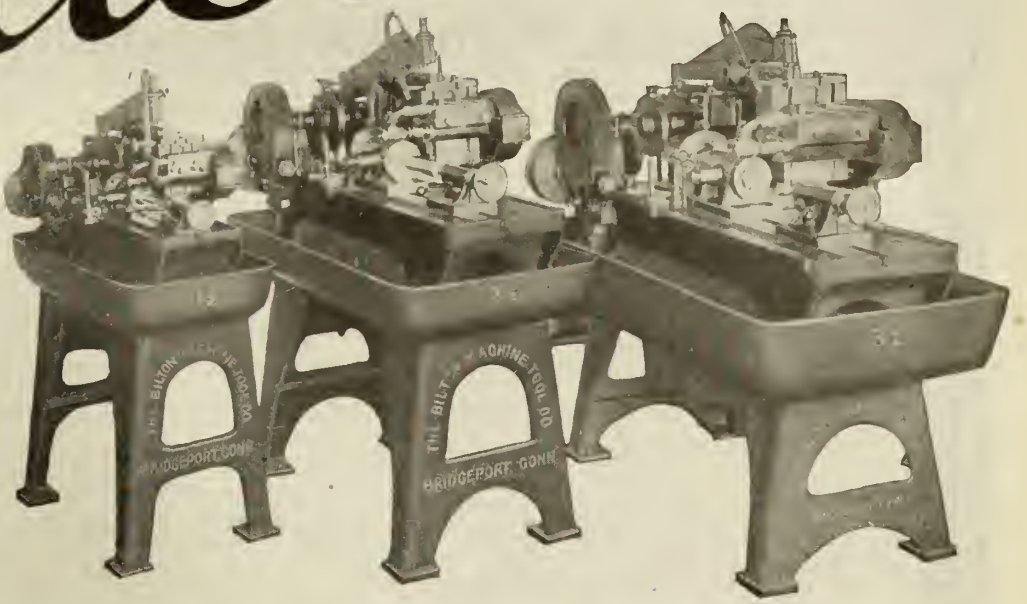
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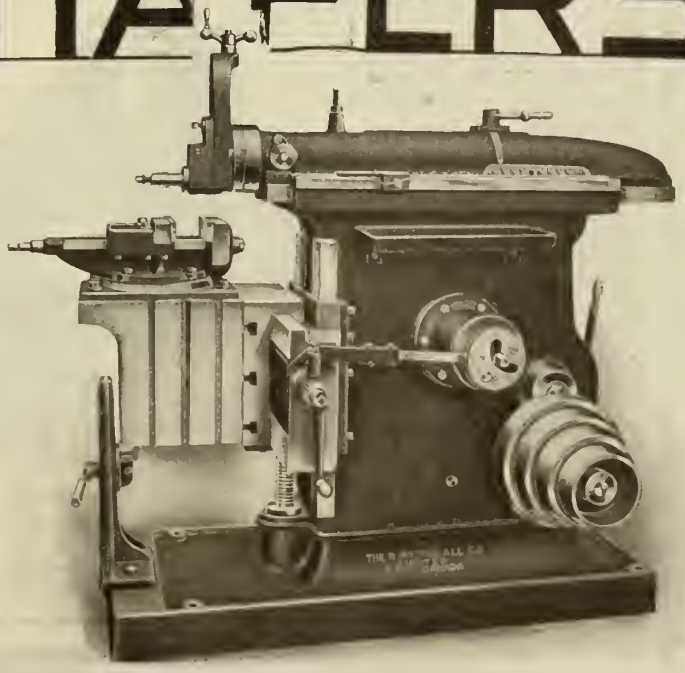
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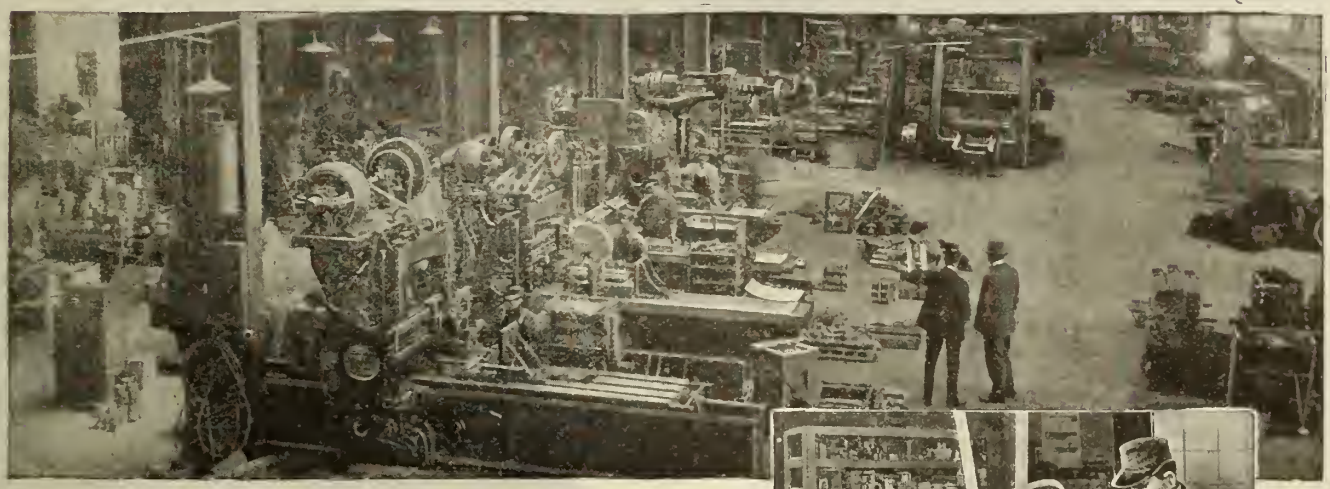
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CANADIAN MACHINERY
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MANUFACTURING NEWS

VOL. XXIV. No. 26 December 23, 1920

Planning Tooling and Operations for Lever

The Lever Under Discussion Is For Use on a Standard Milling Machine—Five Operations Are Entailed, the Only Equipment Used Being a Lathe, Milling Machine and Drill Press.

By E. N. DAVEY

AN important feature in designing the tools and operations for this piece, to my mind, is the equipment of the shop. For my purpose let us suppose it is to be made with an ordinary engine lathe, milling machine, and drill. If a turret lathe and multiple spindle drill are to be used the same equipment can be modified to suit, and would naturally cut the price of production a little. I think this piece could be best handled in five operations, namely.

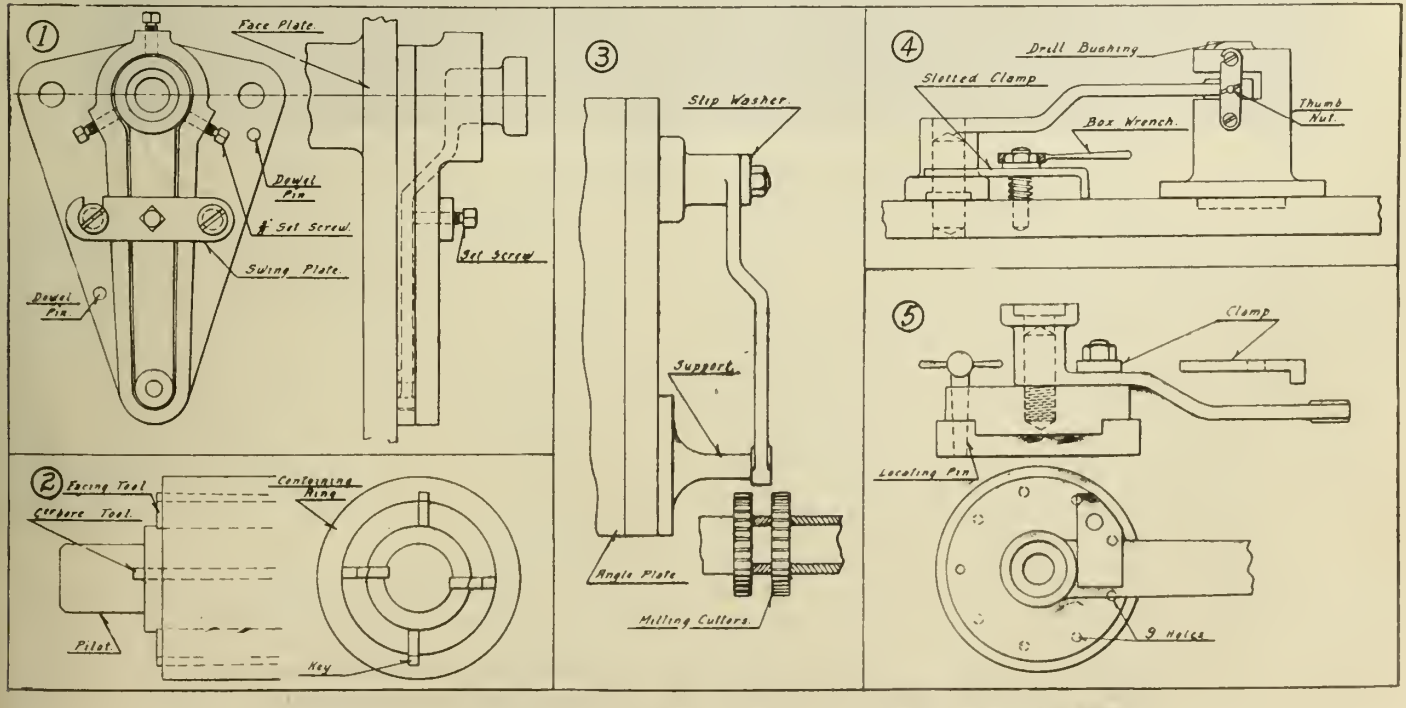
1.—Lathe operation on the large end drill, ream, counterbore, turn outside and face. 2.—Face both sides of the boss on the small end with a pair of milling cutters. 3.—Face the back of the large end on the drill. 4.—Drill the half-inch hole in the small end. 5.—Mill the teeth.

The first operation would require, first, a small fixture to bolt on the faceplate of the lathe for quick setting up. Fig. 1 shows this fixture. It is bolted to the faceplate by two ⅝ bolts, and prevented from sliding by two dowel pins. The piece is placed in the casting as shown.

The casting is made to form, and bored out in position a little larger than the boss, enough to give a working clearance, and held in position by three set screws and a plate. To remove the piece, the top set screw only is loosened, and the plate is allowed to drop down. The outside turning is completed while the drill is being fed through. After drilling and reaming, the counterboring and facing is accomplished with a tool which has a pilot to fit the hole.

Fig. 2 shows construction of this tool. It is a piece of tool steel turned the required shape with a one-inch pilot on the end. Four slots are milled longitudinally to take four pieces of high speed tool steel, and on the outside a containing ring is turned to fit. These tools can be adjusted and are held in position by keys. This tool has the great advantage that in case of breakage it can be pushed further out until the high speed steel is practically worn away. This is the major operation and would occupy about ten minutes.

For the second operation we will take an angle plate and screw into it a one-inch hardened steel pin, threaded at the end for a ⅝ nut. This nut is to be made so that the casting will pass over it without having to remove the nut. A slotted washer is inserted between the



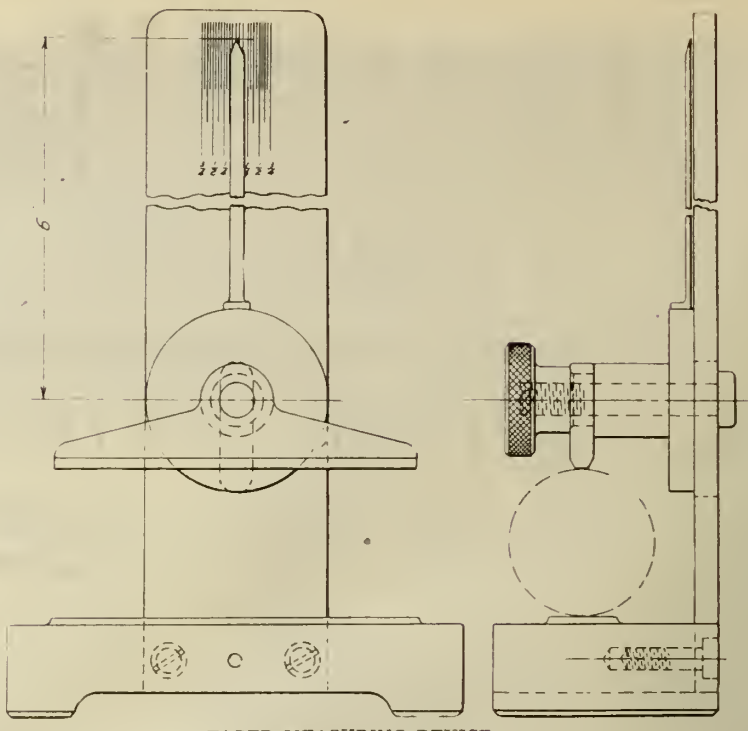
FIGS. 1 TO 5—ILLUSTRATING HOW THE AUTHOR WOULD COMPLETE THE LEVER.

nut and the casting to enable us to tighten up the work.

Some sort of support will have to be provided for the small end to bear on, and the direction of rotation of the milling cutter arranged to thrust the work downward. The angle plate must be bolted to the milling table, so that the distance between the faces after the first piece is completed will come automatically correct. The time for this should be about two minutes.

The third operation, namely, facing the boss, and the fourth operation, drilling the half-inch hole, could be done on the same jig. If a round 12-inch blank flange could be picked up somewhere it would serve to build this jig upon. If not, a casting would have to be made. Drill and tap the base for 1-inch cast steel pin. Make the pin about one and a half inches long. This would leave room for the pilot on the facing tool. Swing the small end on to a boss or raised piece, the right height, and up against a stop, when the piece would then come directly under a hardened drill bushing properly located. It could be held in place by some locking lever device such as at Fig. 4. Time for the two operations, three minutes.

The final operation is milling the nine teeth. The very fact that there is an odd number of teeth allows us to run right across the face with the milling cutter and cut the side of one tooth and the opposite side of the other, and takes nine cuts. If we have any horizontal indexing attachment, the problem resolves itself into one of quick and accurate setting up. If there is no suitable fixture belonging to the milling machine, then a simple holding and spacing jig could easily be made by taking two plates. Make one rotate round the other, hold the work on locating pins and drill nine holes in for spacing. See Fig. 5. Time, about six minutes. Total time, approximately twenty minutes.

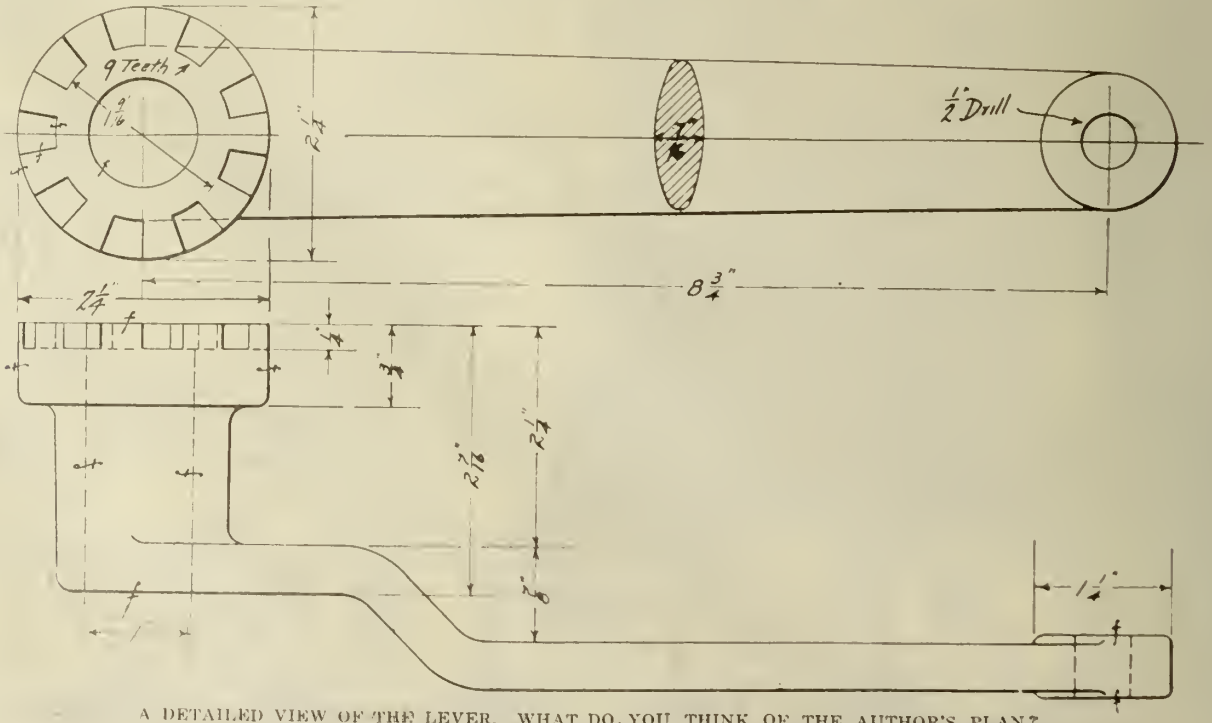


TAPER MEASURING DEVICE.

TAPER MEASURING DEVICE

By John Homewood

The occasion often arises when it is desired to know how much taper there is on a certain piece of work. Very frequently this is required when a piece is wanted for replacement. Many methods for ascertaining this taper are laborious and subject to mistakes in calculations. The sketch herewith illustrates a simple bench gauge that should be a valuable asset to any shop using tapers. The details of construction, and its action, are self evident, and need little explanation. The upright that extends from the rear of the base carries the adjustable swivel bar and the indicating finger, that shows at a glance the amount of taper that is on the work. The working faces of the gauge are hardened and ground and pointer should be set to zero by means of a cylindrical standard.



A DETAILED VIEW OF THE LEVER. WHAT DO YOU THINK OF THE AUTHOR'S PLAN?

Practical Pointers on Rolling Mill Operation

English and American Methods of Rolling—Getting Large Output in Rolling Thin Plates—How to Avoid Waste—Universal and Plain Mills—How to Obtain the Best Results

By W. S. STANDIFORD

AMONG the vast diversity of metal products turned out by the various rolling mills, the rolling of ship plates, automobile sheets and strip steel occupies a front rank position. In view of the above, readers will undoubtedly be interested in reading about roll designs, difficulties encountered in rolling, and other factors entering in the production of the above metal sections.

The term "sheets" is generally applied to flat pieces of metal such as iron, steel or the non-ferrous varieties which are less than one-fourth of an inch thick. From one-fourth inch and upwards, the metal is called "plates," tin plates being an exception to this, the term being applied to very thin sheets of iron and steel which are coated with tin, or a mixture of lead and tin. Plates are rolled in various lengths, their dimensions being limited to the railroad transportation facilities, such as the sizes of cars. There are two styles of plates sold on the market, viz.: "Sheared" and universal plates. Sheared plates are wide ones as rolled in the mill, they being cut to certain sizes in widths as desired by the consumer. In all plate mills there is more or less waste of metal due to the plates having imperfect edges. The economical working of any plate mill depends largely upon the percentage of the metal which has to be sheared from it to remove the imperfect edges.

Avoiding Shear

To avoid having to shear any metal whatever from the sides of long and narrow plates, they are most generally rolled in a "universal" mill. Plates as high as one hundred feet long by six feet wide, and one-half an inch thick down to one foot wide, and one-fourth an inch thick, are produced in this way. The waste of plates rolled on a universal mill will average about 15 per cent. less than those rolled on the average plate mill. The length and thickness of plates which a mill can turn out is independent of the dimensions of the rolls, but the width is determined by the length of their barrels. Thus a 150-inch mill means that the mill will roll a plate 150 inches wide. Plates can be rolled from ingots or slabs, both giving very good results in the finished product. They can be rolled in either two high, or three high mills, the English using the two-high system. In most cases, it is the usual English practice to have a separate set of roughing rolls connected up by means of boxes and spindles to the finishing ones, the rolls being driven by a reversing engine. The reversing engine is not an economical piece of machinery to run, but it seems to be well liked and largely used by English plate mill manufacturers.

The New Plan

The English plate manufacturers formerly used to roll the hot ingots directly into plates without their being reheated, but of late years they have adopted the plan of rolling the large ingots into slabs of four inches or more in thickness, then cutting the slabs while hot into the desired lengths and stored away until required. When needed, they are put into a heating furnace to raise their temperature for the final rolling. More fuel is consumed by the latter method; but, on the other hand, fewer defective plates are made, and taken in general, there is much less strain on the machinery than is the case when the ingot is rolled in one heat, which is the case with the American system of plate-making. These advantages are generally considered by English manufacturers to be more than an offset for the extra amount of coal consumed.

On an English plate mill, the same crew does the roughing and finishing. The crew works the cut slab until the roughing rolls reduce it to a suitable thickness; it then is transferred to the finishing rolls. Two crews cannot be used on this style of mill for the reason that the jerking and uneven action of the roughing rolls interferes with the smoothness of the surface finish of the plates and also with the uniformity of gauge thickness, the plates being rendered with great variations in thickness, hence the advisability of doing the roughing by itself. In the English system the rolls are worked dry, no water being used upon them. This necessitates turning the rolls slightly concave in the middle in order to allow for expansion as the metal expands in the middle more than it does upon the ends of the rolls. When a mill of this type is first started up on a Monday morning, it is customary to roll narrow plates at first so as to get the rolls gradually heated and expanded to a level surface. The general practice in America is to finish sheared plates from ingots or slabs—without re-heating them—on one stand of rolls, the three-high system being used and running water being employed to cool them and prevent overheating and undue expansion.

It may be thought that the use of running water on the plates would cool them very quickly and interfere with their reduction in thickness. The water does not cool these plates as much as might be reasonably expected, because the heat of the plate suffices to maintain the water in a spheroidal state, thus pre-

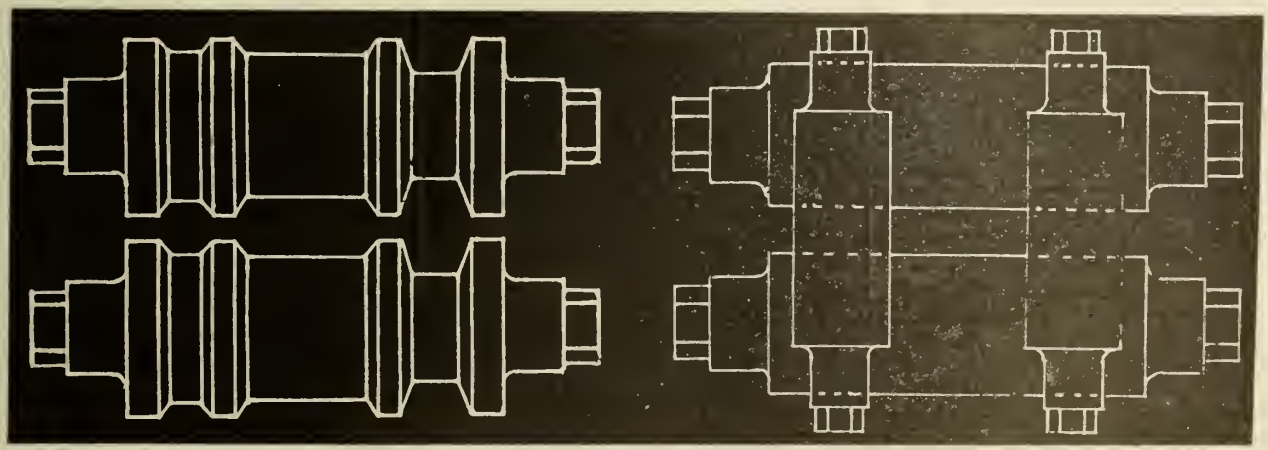


FIG. 1—LEFT HAND VIEW. A TWO-HIGH SET OF BLOOMING MILL ROLLS.
FIG. 2—RIGHT HAND VIEW. ILLUSTRATING HOW THE ROLLS ARE PLACED IN A UNIVERSAL MILL.

venting any close contact between the two.

Water Has Beneficial Effect

Water on iron and steel plates during rolling has a beneficial effect, as it loosens and causes the scale (which contains impurities) to break away from the metal. Iron plates while being rolled contain more scale than the steel ones. This is due to the fact that iron is more impure and porous than steel and it contains lots of cinder and slag, which are worked out by the action of the rolls. Scale on plate, whether of iron or steel, when being rolled, is a nuisance, especially near the finishing stage, because if it is not swept or blown off by compressed air it will invariably mark the finished product. This is due to the fact that the pieces of scale laying on top of the plate will be rolled sufficiently into the surface as to make a slight depression on it. When a set of rolls are used for both roughing and finishing purposes, the wear on the same is greater than is the case where a separate set of rolls are used for roughing down the ingot, as the drafts used are far heavier in the roughing down process. The result of this is that the rolls have to be dressed at more frequent intervals when they are used for both roughing and finishing.

Rolls in Tandem

The American system of using running water to cool plate rolls obviates the necessity of turning them with a concave surface as is used in the English system. When thin plates are to be rolled, the largest output is secured by using a separate stand of finishing rolls, and placing the roughing set in tandem. In this case each set is driven by its own engine, or an electric motor as the case may be in that particular mill. All sets are also in line with each other and connected by tables. By this method, the finishing rolls can be run at as high a speed as is practicable; which not only gives a better surface to the thin plates, but allows a greater output to be secured. The work of the roughing rolls can be so distributed as to synchronize with the time cycles of the roughing and finishing mills. One of the most well liked and generally used types of plate mills is the "Lauth" mill. This is a three-high mill with one stand of rolls. A unique feature of this mill is the manner in which the middle roll is used to support the top and bottom rolls when they are in action. The top and bottom rolls of the mill are 34 inches in diameter and are both of driven variety, while the middle one, which is 24 inches in diameter, runs loose and revolves by friction with the plates being rolled. It is raised or lowered by a hydraulic cylinder to enable the plate to enter the rolls between the middle and top, and the middle and bottom rolls. As the middle roll is ten inches smaller in diameter than the top and bottom ones, it is pressed against the surface of the top roll when the hot steel is being rolled, the thickness of metal in the top roll preventing the middle one from boiling.

Another important point is due to the fact that as the middle roll is smaller in diameter, it has a sharper periphery or contact of surface than both the top and bottom rolls, the result being that the middle one bites deeper into the metal being rolled, thus it has a more rapid reducing action than the larger diameter roll whose periphery is flatter and does not elongate the metal to the extent of the smaller one. In practice, the Lauth mill has been found to be very efficient and it gives good results, being used extensively. This type of mill is made to use cast steel slabs, which are tapered slightly so as to permit of their removal from the ingot mold in which they are cast. As there is no means of edging the slab, the top roll not lifting sufficiently for the purpose, it would naturally roll out a plate that would be wider at one end than at the other, did not the roller take advantage of this fact, that in rolling metal the piece rolled is extended in length, but not appreciably in width.

VALUABLE ADVICE

The author of this article is a practical rolling mill man himself, and knows whereof he speaks. His information is brief and to the point. An article of this nature is well worth filing away for future reference, as it contains many valuable pointers in rolling mill operation. This is only the first part of the article. It will be concluded in our Jan. 6th issue.—Editor.

Bringing Slab to Width

One way to bring the slab to an even width would be to insert it between the rolls, having its long side parallel with their axes. But the main drawback to the method exists in the fact that the slab is too narrow and not wide enough to allow of its being carried sideways on the ordinary roller tables that are supplied with mills of this kind. As it is absolutely necessary, in order to prevent a waste of metal in the finished sheets, that the slab should have an even width at the start of rolling, it is inserted diagonally in the rolls with one corner facing upwards. This reduces it to a diamond shape, it is then turned over by the manipulator and entered on the opposite diagonal corner, with the result that the second reduction has again squared the slab, the process spreading it in both directions. If necessary, this operation is repeated several times by the roller. It all depends upon the amount of carbon that the steel contains, thus affecting the drafts. A slab rolled by this method has a uniform width. The rolling is now resumed in the ordinary manner until the plate has been reduced to the desired gauge. We now come to the design most generally used, namely, the two-high set of blooming mill rolls to reduce ingots for making into slabs and billets. These are illustrated in Fig. 1.

This set of rolls is shown in sketch as having one extra wide slabbing pass in the centre, and two different sizes of billet grooves. As a matter of fact, five or more passes could be cut into the rolls, depending upon the size of the billets desired and also the width of slabs produced. It will be noticed in the sketch that the corners at bottoms of passes are left sharp. This was done in making the sketch to save as much work as possible, the idea being to show the appearance of this type of rolls only. In actual practice, the roll turner always puts rounded fillets at the corners of passes in this style of rolls. This is done so that the corners on the ingot will be worked as much as possible and have a fibrous nature.

Should Be Turned Over Frequently

Rolls of this design are used all over the States and Canada, also in other countries. They are used for reducing the large ingots, the latter being worked in the slabbing pass as they come from the furnace. The ingot is turned over on its side, each one alternately rolled until, if billets are desired, the metal is sufficiently reduced in area to allow it to enter one of the billet passes. It soon gets reduced to a long rectangular shape in these grooves. In order to have the edges of the finished material as free from cracks as possible, it should be worked as rapidly as can be done while it is at a high heat and be frequently turned over so as to facilitate the metal getting into a fibrous condition, which is the object desired by all iron and steel manufacturers.

The slabbing pass in these blooming rolls are put in level by the roll turner, which is the case in rolls used in some mills. In other cases, however, the pass is a convex one; the highest part being in the middle. This design makes an excellent working pass, which does not strain the machinery as much as does a groove having a straight bottom. As the ingots in all blooming mills are turned over at a right angle to the previous position which they occupied, in order that all of their four sides should be thoroughly compressed, the two concave sides of the ingot when being rolled at a right angle to the axes of the rolls, straighten up when their top and bottom are being compressed in the roll pass.

If the ingot is being reduced in a slabbing pass, the metal, owing to the heavy drafts used by the roller, bulges

out at the joints of the rolls. When the bulged or uneven side is turned over and faces the top and bottom roll slabbing pass, it lies over at an angle out of a perpendicular line to the roll axes and not at a right angle on the feed rollers. Should the draft be reasonably heavy, the ingot is apt to turn over in the groove altogether while being reduced. The result is that the ingot is mashed out over the collars of the roll pass next to the one in which the rolling is done, and if the engine is very powerful the roll is either broken or badly bent so that it cannot be used again. On the other hand, if the ingot has its concave sides resting upon the feed rollers, the position of the ingot will be at an exact right angle to the roll axes and also feed rollers, the ingot resting on its corners only, its centres not touching the feed rollers at all.

Gives Fine Results

The advantage of this is that the concave surface of the metal allows the ingot to be easily gripped and quickly dragged into the pass, the merits of curved passes for this class of rolls being of the utmost importance as regards the rapid reduction of steel and it gives fine results under actual working conditions in every class of mill using this style of roughing grooves.

Slabbing and plate mill rolls depend mostly for their drafts on the amount of up and down play which their housings and mechanism permit, it being in the roller's power to use either light or heavy drafts as is considered necessary. It is the usual practice to reduce the steel quickly as possible while rolling. Many rollers in their eagerness to get their day's work done as soon as possible abuse the rolls and machinery by reducing the metal at the utmost possible limit of drafts, which rolls and machinery will stand, thus throwing a continual strain upon the apparatus. The danger of ruining rolls by twisting necks off of wobblers as well as damaging the housings and engines is one that a roller will take risks upon when he is at work, as it seems to be a peculiarity of human nature for men to be careless with other persons' property. By watching the workings of the rolls from a position where the roller cannot see him, a works manager can easily find out for himself if his roller is handling his machinery roughly. When extra heavy drafts are being taken, a heavy cloud of black dust will arise from the rolls while they are in action. This is an infallible test, the black dust coming from the pass surface which is being ground off by the hot ingot metal, which has reached its utmost limit of resistance. The machinery will also be heard to vibrate heavily and make more than the usual amount of noise when extra heavy drafts are being used.

A Waste of Money

Rolls roughly handled require an extra amount of metal taken off by the roll turner when dressing, in order to bring the passes into shape again. Thus there is another waste of money which is totally unnecessary. In working of blooming mill rolls, it is much better to operate them at their maximum safe rate of reduction, which they will stand. A steady, even pace, with no interruptions caused by breakdowns, is much better than a spasmodic effort being made to break tonnage records with its evils of straining the machinery, that sooner or later causes a shut-down ahead of its time for repairs. Excessive reductions also produce slabs that are thicker in their centres than at their edges. To give an idea of the amount of wear that a set of normally used blooming rolls undergoes while they are rolling all kinds of ingots comprising both soft and hard steels, the following measurements were taken from a set of worn rolls that were sent to the roll lathe to be dressed. These rolls contained four billet and one slabbing pass; the sides of the billet grooves being worn out 3-16 of an inch wider than a templet which is used by the roll turned to keep them the same width. It will be observed in the sketch of blooming mill rolls that the grooves have tapering sides. There is a two-fold object in putting them in with tapering collars, namely that by having grooves with slanting sides, the hot metal touches a bottom point of the groove before it grips the wider part at top, the result being that there is no shearing of metal from ingot at the top part, which would be the case if the groove sides were straight, the sheared metal from ingot coming off in the form of narrow splinters.

Sides Parallel With Roll Axes

Should they be put in the rolls straight—that is, having their sides parallel with the roll axes, and they wore out 3-16 inch at their sides, it would be impossible to make them fit templets no matter how much metal was taken off of the rolls in turning. To make these worn roll grooves again fit their templets, it was necessary for the writer to take 11-16 inch from the collars or tops of the rolls. A corresponding amount was removed from their bottoms so as to keep the depths the same. In regard to the total amount of time consumed in doing this work on both rolls, it required 4½ days, the tool used having a width of 3½ inches.

The roll lathe was driven by a 15 h.p. direct current electric motor, the latter having more power than was really necessary. The writer while doing the turning desired to know the exact amount of power that was needed, and had the chief electrician discover the amount necessary to operate the lathe on both roughing and finishing cuts. With the above width of tool, it took 7 h.p. to sustain a steady roughing cut and 3¼ h.p. for the finishing one. Each roll was 26 inches in diameter and weighed over 8,000 lbs.

A type of mill also much used in this country is called the "universal" mill. It is adopted extensively for plate-making and jobbing work. This mill consists of a pair of ordinary plain cylindrical rolls mounted in the usual way, and at the back of these a shorter pair of similar rolls, which are mounted with their axes in a vertical position; so that they will compress the edges of the bar at the same time that the horizontal rolls compress it on its flat sides. This arrangement obviates the necessity of the ingots having to be turned over on their sides so as to work the edges that face the joints between the collars of rolls, which is the case with slabbing rolls.

The vertical rolls are, as a general rule, made smaller in diameter than the horizontal ones, and they are driven from their upper ends by means of mitre-wheel gearing which operate other bevel gears keyed onto a shaft crossing the top of the housings. On the end of the shaft is a spur wheel working into the upper pinion in the pinion housings, or with a spur wheel keyed to it. Originally, the vertical rolls were driven from their bottom ends, but scale from the steel being rolled kept falling into the gearing and caused the teeth to wear out rapidly so that they are now driven from their top ends. Fig. 2 illustrates how the rolls are placed in a "universal" mill, no gearing being shown in the sketch.

Width or Thickness

It will be seen from this combination of four rolls that any width and thickness of flat plates within the compass of the mill can be produced with equal facility. Universal mills generally make plates up to 6½ feet wide. Of course, there can be wider plates made by this method of rolling if the rolls are made sufficiently wide and thick in proportion to the work that they have to do. Plates made on such mills usually have their edges straightened by pressing them while hot on the floor between two bars, which are squeezed against the plates laterally. If the piece of metal rolled in a universal mill is not entered by the roller perfectly square, or if it bears much harder on one vertical roll than on the other—it will be curved in a horizontal direction; and the same thing will occur if the plate is unevenly heated; the hotter side elongating more than the colder one, and once it is bent it is not an easy matter to straighten it. The effects of uneven heating in the working of the steel in the rolls, shows in the finished product, it being of vastly greater importance that the material shall be uniformly heated, even if it does take more pounds of fuel to do it. Unevenly heated and crooked plates not only give trouble in turning them over and handling them on the castors, but their

thickness varies in different parts, which is due to the many hot and cold spots on the plate. When the outside of a plate is cold and its interior hot, this condition causes the rolls to spring and the housings to stretch appreciably when rolls reach the cold spot. It will readily be seen from the foregoing that it is a very difficult matter in the case of long plates to keep the gauge thickness uniform, so that if one end of a long plate is much colder than the other, it will be found to be thicker than the other.

When very thin plates are rolled this is a constant source of trouble, for in the manufacture of thin plates and long narrow strips, they cool so rapidly that their last ends are always colder and thicker than the first. In the universal mill the speed of the surface of the vertical rolls located at the back of the housings must be greater than that of the horizontal ones through which the bar is passed, the amount depending upon the extent of the draft which the roller uses at each pass. Any deficiency of the surface speed of the vertical rolls will prevent them from passing the metal contained in the bar as fast as they received it from the horizontal ones, and it would—if thin—accumulate in a mass of crumpled and bent steel between the rolls and be spoiled.

To avoid this, the vertical rolls should always be run somewhat faster than is required theoretically, which is a matter depending upon the skill and judgment of the roller if good results are to be obtained. As it is impossible at times to guard against a workman using too much draft at a pass, its speed must in practice be very much in excess of the correct amount. On the other hand, if the speed is too great this involves much slipping of the edges of the bar against the surfaces of the vertical rolls, which rapidly wears them out and absorbs much power uselessly, causing a considerable "backlash" which is very destructive to the gearing.

Avoid Backlash

Backlash on rolls takes the form of a succession of slips and jerks. Even if the surface speed of the two sets of rolls is correctly proportioned when they are new, the relation between their diameters is soon destroyed as they are turned down too correct for wear; as vertical rolls do not wear evenly with the horizontal ones.

It is the usual practice in most mills using steam power to operate their rolls to drive the horizontal ones by a reversing engine, while the vertical rolls are driven by a second separate set, but of less power. Taken all in all, the universal mill is not an easy one to work, much skill being needed on the part of the roll adjuster to keep the same working smoothly. Constant vigilance must be exercised on his part as the bearings and roll surfaces keep wearing and need looking after. The advent of the automobile has created a demand for sheets of the highest grade and quality, a demand which is exceedingly costly and difficult on the manufacturer's part to meet, as in the rolling of these sheets there are always some that contain slight imperfections such as surface blemishes, buckles, roll marks, furnace scale, pitting caused by the rolls wearing down near the end of the chill depth, and also dirt dropping on the metal from the point of the workman's tongs, which are allowed to rest upon the floor while metal is getting heated.

Sheets having slight imperfections are termed "seconds," and in order to make any money at all on this class of sheets the manufacturer generally insists that the automobile plant absorb a small proportion of these seconds, a price reduction being made on defective ones. Automobile sheets are mainly divided into three classifications. Number one is called body stock. The second is termed splash-guard, hood, door, apron and flat fender stock. The third, crown fender, radiator casing and cowl stock. There are further subdivisions of these classifications that consist in the steel analysis and also the hardness of temper which is imparted to the sheets by cold rolling. The bars from which automobile sheets are rolled are treated differently from those used to make ordinary ones, such bars being pickled in acid so as to remove scale and other dirt. There are also many other operations gone through, such as repeated picklings and annealings that the ordinary brands of sheets used for other purposes do not undergo.

Each mill that manufactures sheets for the automotive industry has its own method of getting results, but they all resolve themselves into rolling and producing the highest grades of sheets that are possible. Cold rolling figures largely in the obtaining of a high finish on sheets, but it also has the drawback of hardening the steel to such an extent between successive rollings, which are necessary to reduce the metal to the desired gauge, that frequent annealings between each rolling are required, otherwise the metal would become very brittle and crack.

Even the softest quality of steel is hardened or stiffened by means of hammering, drawing, or cold-rolling. Cold rolling increases the elastic limit and ultimate strength but also decreases the ductility. Body steel is divided into the following varieties or classifications: bright finish, and velvet or dull finish. These are again divided into standard stamping or drawing metal, deep drawing metal, and extra deep drawing quality. The bright finish is a glossy shining surface and it is intended for japanning or enameling. The velvet surface sheets have a grain that is more or less open, which is intended to hold the paint, these sheets being made for hand coating. The painting operations are priming, rough stuffing and an air-drying enamel that needs no baking. Such sheets are admirably suitable for work of that character. The deep drawing quality is also used for parts that have shallow depth. Back and side panels usually are made from this quality of steel. The extra deep drawing quality of metal is produced for very difficult drawing operations such as seat backs, wheel housing, and other parts. The seconds from this class of sheets can be used by glazing over the imperfections with putty. Door, apron, splash-guard and fender-stock are made from a grade of sheets that need to have a very high finish as it has to be enamelled or japanned.

This grade of sheets has a closer grained surface than the body stock, but it will not stand much bending and it should be used for work that has no very sharp angles and that is comparatively flat. Deep drawing and extra deep drawing steel ought to be ordered for work requiring deep bending. After sheets for automobile bodies have been rolled they are next run through a series of small rollers to straighten them. This process removes any small buckles or strains that were caused by uneven annealing or other causes.

Making Sheets Straight

This method of straightening does not leave them absolutely flat. To make them level it is necessary to stretch them in a hydraulic operated device called a "stretcher leveler," which makes them absolutely straight and flat. It is not necessary to use stretcher-levelled sheets if they are to be drawn through dies, as the drawing operation will usually absorb any small buckle in the metal, providing the sheet is not badly or deeply buckled. As the sheets made for automobile manufacturers are liable to rust while they are in a warehouse, they should be oiled and crated ready for shipment.

Most automobile sheets are made in Nos. 19, 20, 21 and 22 United States standard gauge, and should be ordered in that gauge and not in thousandths of an inch. The writer believes that the time is coming when some of the alloyed steels such as vanadium, chromium, etc., will be made into sheets for motor cars as it certainly would have great advantages in regard to lightness and strength. If the new stainless and rustproof steel could be used in sheet form for automobiles it would give good satisfaction, as once the enamel peels off of the ordinary sheets used in our autos it doesn't take long for rust to form on the metal's surface, the result being that when a car has to be re-enamelled it takes a lot of work to make a smooth job on the rust spots. Using rustproof sheets would save a lot of time and money in this respect.

To Be Continued

Increasing Production With Pneumatic Tools

The Selection, Operation, Maintenance, and Repair of Pneumatic Tools Are Important Points. Different Methods of Driving Rivets, Method of Starting Hammer, Etc., Etc.

THE need of accelerated production in the shipbuilding and engineering industries has resulted in a greatly increased use of the portable pneumatic tool (which has now been developed to a very high degree of efficiency). Pneumatic tools with their percussive action are peculiarly adapted for riveting, chipping, caulking, etc., and are extensively used in shipyards, on bridge and constructional work, while in foundries and steel works their value for fettling castings and removing seams from billets is fully recognized.

The selection, operation, maintenance and repair of pneumatic tools are subjects which demand careful consideration. The hammer selected should be powerful and rapid in action and should operate with a minimum of vibration. The design should be well balanced and the form of the tools such that they are convenient to hold and guide without undue fatigue. The driving of rivets with a pneumatic hammer is a strenuous job and calls for a man of strength and stamina seasoned by experience.

The riveting hammer may weigh anything from 16 to 25 pounds and will strike from 600 to 1,000 blows per minute. The length of stroke varies for different hammers between the extremes of 5 and 9 inches. For general purposes, however, it may be assumed that a hammer of 6 inch stroke will answer most needs in a satisfactory manner. Vibration is unavoidable in a pneumatic hammer, but in modern designs this trouble has been reduced to a minimum. Excessive vibration greatly increases the difficulty of holding and guiding the tool, and, of course, occasions the operator undue fatigue.

There are two methods of driving rivets at present in use on shipwork, first, the "two man hand gang" method, and, secondly, the one man "pneumatic machine" method. Driving rivets by hand requires natural aptitude, training, and experience with the result that, generally speaking, the hand gang riveter is probably more adept than the machine riveter and this is undoubtedly the reason why hand riveting has in the past been considered superior to machine work.

One authority has said, "Give a good machine riveter who understands his business a good pneumatic hammer, proper air pressure, well heated rivets, and he will do more work than the hand gang, with the results equally good."

In the actual driving of rivets the results depend largely upon the skill of the man operating the tool. Given average endurance, however, almost any man of reasonable intelligence can quickly learn to perform the operation with success. The points to be observed in riveting, if good tight joints are required, are as follows:

The holes must be practically in line. The plates must be well bolted together. The rivet heads must be well up against the plates. The rivet must be hot enough to expand and fill the hole for its entire length when driven. The holding up device must keep the rivet firmly in position. The riveting hammer must have sufficient power and speed to form the rivet before it becomes too cold to fill the hole.

A rivet which is loose in its hole may be caulked up to pass test, but will not carry its estimated proportion of the load under stress, and a large percentage of such rivets will lower the efficiency of a joint to the danger point.

POINTS TO REMEMBER

Pneumatic tools with their percussive action are adapted for riveting, chipping, caulking, etc. They are used in shipyards, bridge and construction work, while in foundries and steel works they can fettle castings, and remove seams and defects from billets.

Be careful in selecting the tool to get one suited for your work. After you get it, take care of it. A tool cannot do good work if it is not cared for properly. The most trifling faults are liable to throw pneumatic tools into disorder, causing them to stick and kick.

When rivets fit easily in the holes, and the latter are clean cut and sound on the head side, excellent work may be performed by the use of a simple pneumatic "holding-on" machine. In repair work, especially where old rivets have been cut away, these conditions do not hold good, and it will be found that the holes are ragged on the head sides, preventing the rivets from being pushed home.

In these circumstances recourse may be made to one of the hammer or jam holding-on machines in which the thrust cylinder is combined with a hammer which may be operated to drive up the rivet and then shut off without interfering with the thrust. In button head riveting, the head assists the operator to hold the hammer in place, but when flush riveting is required, such as is used on the outside of a ship, the hammer must be guided and controlled without this assistance.

The appliances known as shell rigs are frequently resorted to in these circumstances for supporting the hammer when on the outer shell of a vessel. In driving button headed or cone headed rivets, the machine should be sufficiently powerful to form perfect heads without rocking to work down the edges. The hammer should be started off lightly until the rivet has settled somewhat into the hole to prevent bending to one side.

The following are actual times taken to drive button headed rivets with an AW No. 6 riveting hammer: ¾ inch diameter rivets, 3 to 4 seconds; 1 inch diameter rivets, 5 to 6 seconds; 1¼ inches diameter rivets, 12 to 14 seconds; 1⅜ inches diameter rivets, 17 to 20 seconds.

The necessary equipment for driving flush rivets includes a pneumatic chipping hammer and several chisels for cutting away the surplus material. The difficulty of driving flush rivets, is the necessity of getting the rivet's head to a point in order that the surplus metal may be chipped off while it is still hot and soft. The operation is complicated by the difficulty of holding and guiding a flat set on a flat surface.

The duty of the holder is to ensure that the rivets are placed in the holes hot and that the heads are well up to the work conditions, which are essential if good tight work is to be done. For general use with air hammers the "pneumatic holder up" is coming into increasing favor. The construction of these tools is very simple. A solid piston of about 3½ inch diameter works in a shoot cylinder, and is operated by compressed air at the same pressure as that used for the riveters. One end of the piston carries a snap or die adapted to fit the head of the rivet, while the other end of the machine is extended by screwing on suitable lengths of tubing to reach some solid backing. Upon opening the valve, the piston moves outwards and the rivet is firmly pressed into position.

As previously remarked, there are other forms of pneumatic holders in which percussive action is available in addition to thrust, which are of value where the holes are tight or the plate surface unlevel.

The maintenance of pneumatic tools is an important subject which is not always given the care and attention it deserves. The pneumatic tool store should be equipped with a plentiful supply of spare parts and such accessories and conveniences as experience has shown to be necessary, while repair men should be competent to remedy all minor

defects with a minimum of delay. Only a small percentage of repair men ever learn exactly why or how pneumatic tools operate, but they can all learn to keep them in their original condition as delivered from the factory.

Even this is not such a simple matter as it would appear, but it may be accomplished with a little care and observation. The most trifling faults are liable to throw pneumatic tools into disorder and cause them to stick and kick or start badly. As bad tools invariably lead to bad work, it is important to impress upon workmen the necessity of at once returning defective hammers to the stores. When a hammer kicks and sticks or is otherwise out of order, a riveter may frequently put up with it rather than risk the delay involved in journeying to the store for another tool, and as a result work is done which later may have to be caulked or cut away.

When machines are returned for cleaning and adjustment, the repairer should carefully examine surfaces which fit together to form air-tight joints, remove any burrs with a fine flat file, take away sharp corners, and slightly countersink pin holes. He should try, on a heavy block of wood arranged for this purpose, one of the hammers which is known to be in first-class working condition. With the working characteristics of this machine as a standard, he will readily learn how fast a machine should run, how much vibration is to be expected under normal conditions, and how rapidly the steel should cut into the wooden block when the machine is developing its full power.

With these standards in mind the repairer can test doubtful machines and judge by comparison whether they are right or wrong. A good repairer will become so familiar with the machines under his care that he will be able not only to state positively if they are in good or indifferent order but to readily diagnose faults. When a machine has plenty of power, but is slow, kicks, or refuses to start promptly, it will be generally found that the piston or the valve is not working freely. When in good order the piston should slide the entire length of the cylinder when tilted by reason of its own weight. If it fails to do this an examination will usually reveal high places on the pistons which are fouling the cylinder walls. These should be carefully reduced by rubbing with fine emery cloth. Rough spots on the cylinder walls should also be looked for and treated in a similar manner.

The valve should be carefully examined for burrs or high places which would prevent it from shutting closely on its seating and it should be noted that it is sliding freely through the whole length of its travel. A badly seated valve permits an escape of air which, although apparently insignificant, will be sufficient to cause a hammer perfect in all other respects to work badly. If the valve is working too easily it will open and close the ports and so reserve the flow of air before the piston has had time to follow its action, and care should therefore be exercised in easing a tight valve to ensure that the operation is not carried too far.

It is assumed that the repairer will clean out all drilled parts and pin holes, being careful not to overlook the smaller ones. It frequently happens that a mysterious loss of power may be traced to a leakage occurring between faces which should form airtight joints, this being owing to the edges becoming burred by careless handling. Such burrs should be removed by means of a smooth file and the faces tested for inequalities by the use of a little blacking. Occasionally the failure of a hammer to start promptly may be traced to leakage at the throttle valve situated in the handle.

Such a leak, by filling the ports and passages of the hammer with live air, forces the piston to take up a position in the middle of the cylinder covering the exhaust ports, with the result that when full air pressure is applied the piston remains stationary in this position. Usually a tilting of the hammer combined with a slight tap is sufficient to overcome the equilibrium of the piston and start the hammer, but a machine which persistently exhibits this fault should be fitted with a new throttle valve without delay.

It may be taken as granted that the only way to ensure that pneumatic tools are properly cared for and maintained in good order is to insist upon their return to the stores at the end of each day's work. The repairer will then run each machine for a few moments and lay aside for further investigation any which in his opinion exhibit signs of disorder.

Those passed as satisfactory should be arranged on racks and lowered bodily into a tank of mineralized oil for the night, thus ensuring that no internal corrosion can take place as a result of the condensation of moisture from the air supply. It will often be found that a simple soaking in a tank of mineralized oil for a period of fifteen minutes will remedy a defect and obviate the necessity of dismantling a tool for repair.

Many of the foregoing remarks apply with equal force to other types of pneumatic tools as well as to riveting and chipping hammers, and the question of maintenance and repair should receive the most careful attention if good work and high efficiency is to be obtained from an installation.

LARGE STEEL PLANT

A huge electrically driven steel plant called the Winshu works, situated at Yawata, Japan, have had their equipment sent from the United States, the estimated cost being $3,700,000. The initial plant will include three 50-ton basic open-hearth furnaces, a 20-unit producer plant, an 84 in. plate mill, and a 24 in. structural mill. A motor-driven 35 in. blooming mill is to be installed later. The three basic open-hearth furnaces will be served by twelve Smythe gas producers. The 84 in. three-high plate mill, which is nearing completion, is of the Lauth type, and will be driven by a 2000 horsepower motor through herringbone reducing gears and pinions; the motor running at 420 revolutions per minute makes the mill speed 56 revolutions per minute. This company has its own blast furnaces, coal and iron ore mines, and firebrick plant in China, so that it will be the most completely self-contained organization in the Far East.

USEFUL INFORMATION

Where should I use Babbit, and when should I use bronze? If you have ever asked yourself that question, read what Brass World has to say on the subject. Babbitts as a class show high plasticity combined with low Brinnell hardness and compression strength, and these properties limit their application. Bronzes are therefore used where higher physical properties are desired to resist pressure or impact or to provide longer service. Whereas in the case of the babbitts, the softer element is the major constituent, so in the bronzes it is the minor constituent. Bearing bronzes are in general, copper-tin matrices filled with lead. The term bronze applies strictly to copper-tin mixture as differentiated from brass—a copper-zinc mixture. These terms are frequently loosely used, and it is quite common to speak of bearings as brasses. On the other hand, manganese bronze, Tobin bronze and a multitude of other so-called bronzes are in reality brasses, to which possibly one or two per cent. tin has been added, and aluminum bronze is usually a mixture of copper and aluminum, sometimes with a small quantity of iron.

NEW USE FOR AEROPLANE

A new use for the aeroplane has been discovered in Canada in carrying out surveys of mosquito-breeding areas. In undertaking such surveys, says Dr. C. Gordon Hewitt, the Dominion entomologist, one is often confronted with the difficulty of mapping out the swamp areas and other breeding places quickly with any degree of accuracy. By means of an aeroplane photographic surveys can readily be made. In forest work also it may be possible to use such a machine for making surveys of timber that is being killed or has already been destroyed by forest insects.

A process is said to have been developed in England for extracting alcohol and its derivatives from coke-oevn gas on a commercial scale. If applied to the whole of the coal carbonised in Britain, the process is estimated to yield 50,000,000 gallons of motor spirit per annum.

Lubrication and Its Importance to Industry

By A. H. NOYES

THIS is truly the age of machinery. The mechanical inventions of the past fifty years have been marvelous. Watching certain modern machines, with their giant arms, manipulating with absolute ease seemingly impossible loads, and watching still another type of modern machine performing operations delicate enough for a woman's fingers, it is almost impossible to refrain from looking for the god, sometimes the demon, who must be hiding behind the machine and working the levers.

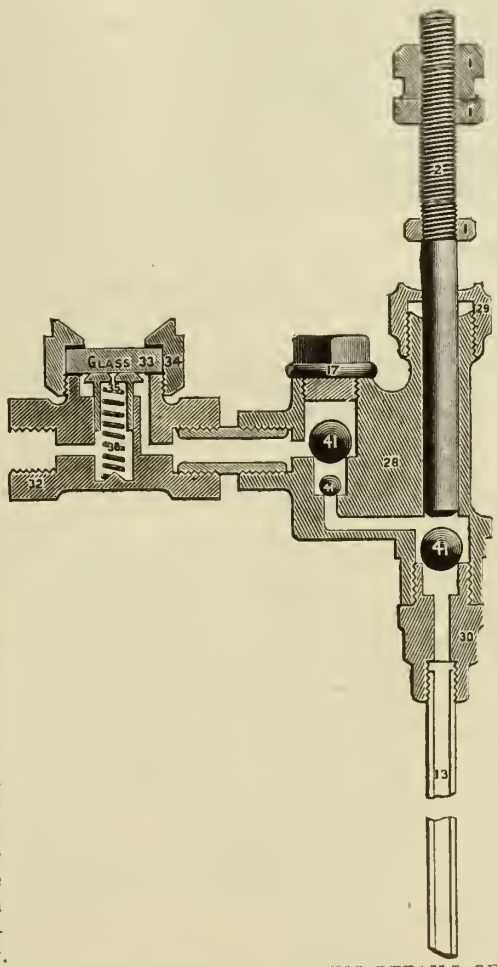
Did you ever stop to think that this intricate and often delicate machinery depends absolutely upon one thing, a thing that can not only stop every current and cog and wheel but damage the whole apparatus beyond repair? Does one person in a thousand realize that this tiny thing, which nevertheless has the life of the whole tremendous mass of machinery in its power, is a drop of oil? What irrevocable damage is caused by two metal surfaces sliding, rolling or grinding over each other, if there is no lubricating substance between.

Ever since machinery has been in existence, lubrication has been its companion. In fact, it existed even before there were machines, when it was simply a case of reducing the power necessary to push one surface over another. People did not know the word friction, did not even know what lubricant meant, but they did know that a little bit of fat or grease made the sliding a lot easier. Even today, in the island of Madeira, the natives' ox-carts have runners instead of wheels, and to assist the patient animal, the driver runs ahead with the "grease rag," with which he smears the cobble stones of the roads. From years of greasing they look like polished ebony.

It is a far call from a wooden sled sliding on cobble stones to two highly polished metal surfaces gliding over each other in a delicate machine, to the powerful piston of a great ship sliding back and forth in the cylinder pushing the whole weight of the ship before it, or the wonderful roller and ball bearings which do so much to reduce friction, and consequently the cost of motive power today. So it is a far call from the grease rag of the Madeira native to the marvelous automatic force feed lubrication of the present day's genius. If the yelling, gesturing native become a bit too tired of running back and forth with his "grease rag" it is only a little more sweat and effort from the patient ox that is at stake, no one hurt, no damage done, only a little more time wasted, and time is a drug on the market with the natives.

But when two polished metal surfaces slide over each other, unoiled, they have a fatal tendency to stick together. Then what? Bearings destroyed, cars delayed, ships at the mercy of wind and wave, time which is worth millions lost, contracts forfeited, and incalculable damage done. Lubrication, then, becomes the sine qua non of industry. This seemingly unimportant thing becomes of prime importance and must be considered from two viewpoints. The first of these is the selection of the lubricant, and the second is the continuous application of this lubricant to the bearings in the amount required.

Only a child would attempt to lubricate the highly polished bearings of an



SECTIONAL VIEW ILLUSTRATING DETAILS OF THE FEEDING MECHANISM.

astronomical instrument with graphite, or to put crude oil in the delicate movements of a watch, neither would highly refined machine oil be of great service in the bearing of a cement crusher. But between these wide limits there is an infinite number of degrees of refinement, and much of the life of a machine depends upon the selection of exactly the right lubricant.

However, the utmost care and the most expert knowledge might be exercised in selecting just the lubricant suited for a machine, and little use would it be if it never reached the bearings. A poor lubricant that reaches the spot is much better than a perfect one that stays in the oil tank. This is where the element of human frailty formerly entered. The man with the oil can was often more important than the president of the company, his mistakes would sometimes be more costly, and both the president and the oiler were liable to error. Men have such excellent "forgetteries." Add to that characteristic the universal tendency to carelessness and to "slighting the job," and you have in humanity a woefully deficient oiling machine.

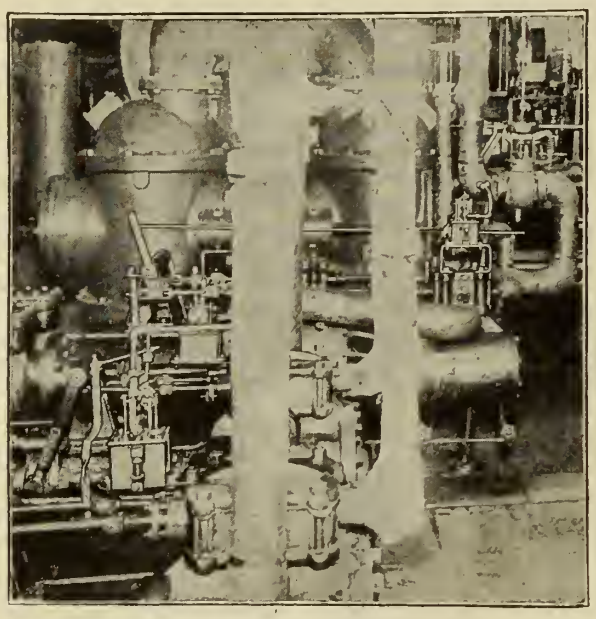
Some accurate and reliable lubricating instrument had, therefore, to be devised. There were, however, certain advantages that the human oiler did have: the machine which should replace him must incorporate all of these advantages to a higher degree, and, in addition, it must not get out of order. So came into existence the force feed lubricator. For instance, the lubricator must start work as soon as the machine starts and must deliver oil in proportion to its needs. A ratchet driven pump was found to best fulfill these two conditions. The motor driven pump of course does not vary its stream of oil and the hydrostatic pump was no more successful. In the latter type the steam condenses in the condensing chamber and forces the oil drop by drop to the bearings. This is successful enough when the machine is working slowly, but when it works rapidly, so much live steam is passing into the chamber that it does not condense fast enough and therefore does not feed the required amount of oil just when the need is greatest.

Hence the ratchet driven pump, to my mind, has almost supplanted other types. It derives its power from a moving part of the machine and consequently stops and starts and accelerates or retards its own speed exactly with the machine. It therefore regulates its delivery in direct proportion to the needs of the machine.

Some of the pumps are fitted with worm gears. These are especially adapted to high speed steam units such as direct connected light engines and sawmill steam feeds of the reversible rotary type. But the "man with the oil can" was not affected by heat or cold, and if working in flying dust he might rub his inflamed eyes, but he still kept on oiling. The best modern force feed lubricators have heaters incorporated in them and they are more oblivious to cold than any man. They do not solidify in winter, therefore, and they do not over-

feed in summer. The only way to avoid dust clogging was to place the oil in a solid box free from the working parts. This principle, as soon as discovered, was applied in the most advanced type of pumps. In this way it was made absolutely impossible for flying dust and grit to get into the oil and be carried to the bearings.

Although accuracy and reliability of action were probably the chief considerations in the mind of the originator of these pumps, yet they have been found to effect a very great economy in oil, as well as in man power. Some of the pumps are credited with saving from 50 per cent. to 80 per cent. of oil—a not insignificant matter in these days; and



THE LUBRICATOR IN SECTION.

The working parts should be as simple as possible and they must be easily reached and repaired. One model has a one-piece valve which eliminates practically all troubles, for it is obviously impossible for a solid casting to get out of order. All the working parts of this model are on the outside of the oil reservoir, which probably accounts for the absence of repair bills for continuous service.

The sight feed is one of the latest and most important devices added to the force feed lubricators. The sight feed leaves the action of the lubricator visible so that an interruption in the flow of the oil is immediately detected. By its means, also, the engineer can see exactly the quantity of oil going to the various bearings.

The lubricators also have several chambers in the oil reservoirs, as many as required, in fact, and can therefore deliver different oils to different bearings. This is necessary to the life of any machine. Pumps of all sizes are in use, from the very small one-feed pump to the one holding several gallons of oil and delivering by forty feeds. The larger pumps or, as they may be called, pump systems are designed for the location they are to occupy. The lubrication of an entire plant is thus controlled from a central point. The economic advantage of such a system is unquestionable. To such an extent is this recognized that practically all the large power plants and all marine engines are equipped with automatic force feed pumps.

the cost of the wage which would have been paid to an oiler doing the work of its forty feeds.

Recent years may have produced more marvelous and more intricate machines than the force feed lubricator, but none to my mind that have demonstrated a greater usefulness or a more perfect adaptation to the needs they were designed to serve.

HOW TO KILL ANY SOCIETY

We often hear how we can help things along, but it remains for the Michigan Architect and Engineer to tell us how we can kill any society or association.

There are ten ways to kill an association, they say, and here they are.

1. Don't come to the meetings.
2. But if you do come, come late.
3. If the weather doesn't suit you, don't think of coming.
4. If you don't attend a meeting, find fault with the work of the officers and other members.
5. Never accept an office, as it is easier to criticize than to do things.
6. Nevertheless, get sore if you are not appointed on a committee, but if you are, do not attend the committee meetings.
7. If asked by the chairman to give your opinion regarding some important matter, tell him you have nothing to say. After the meeting tell everyone how things ought to be done.
8. Do nothing more than is absolutely necessary, but when other members roll up their sleeves and willingly, unselfishly, use their ability to help matters along, howl that the association is run by a clique.
9. Hold back your dues as long as possible, or don't pay at all.
10. Don't bother about getting new members. "Let George do it!"

TAPPING SOFT METALS

In tapping soft metals such as aluminum, there is quite often some difficulty in starting the thread, as the tap will at first either ream out the hole in a partial manner or strip the thread after it is started.

Both these dangers can be avoided, and perhaps the simplest method of all is to make an accurately threaded guide block about the same depth as an ordinary nut.

By placing this guide block in correct position over the hole to be tapped, no trouble will be experienced as the tap must then travel through the soft metal at a predetermined rate. Of course the guide block must be clamped to the work. It is essential that the block be fastened, and another point to be watched is the use of a good lubricant.

Whenever dealing with soft metals, do not rush the job. Humor it, for owing to the weakness of the metal it is likely to break away if too much force is used. Even copper can be stripped if two much force is adopted. If cutting threads on the lathe the danger is not so great but even there it is necessary to use the best of care. Above all see that the cutting tools are sharp. If you don't the results will be far from perfect.

Some recent tests to determine the proper amount of air required for special thermit welding gasoline and compressed air preheaters showed that 25 pounds per square inch seems to be a practical minimum. At this pressure, a single burner preheater will require approximately 25 cubic feet of free air per minute and a double burner preheater approximately 50 cubic feet. For very large welds, where the walls of the molds are thick and the preheater gates longer than usual, a pressure of 40 pounds per square inch would be advisable. This would require approximately 35 cubic feet of free air per minute for a single burner and 70 cubic feet of free per minute for a double burner.

A coating of magnesia cement on the timbers of mines is stated to be an economical and efficient assurance against fire, especially in the arid regions where timber becomes highly inflammable and is difficult to replace. It is elastic, adheres firmly to almost any surface, and is stable and durable.

Have You Tried This Contest Yet? If not--- Do so Now

It's very easy, and at the same time you add to your store of knowledge. The details are given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

The Prize Winner for December 2nd Issue List is NORMAN POTTS, Monarch Tractors, Ltd., Brantford, Ont. He Had All Answers Correct.

CONTEST FOR DEC. 23RD ISSUE

Contestants are required to write us, stating to which advertisements we refer in this number.

1—Something you can install with your bare hands in five minutes.
2—A discussion about the number of teeth necessary to do different jobs.
3—A product said to be known to the four corners of the world.
4—A product said to drive a certain tool straight and true.
5—A machine that indexes during the return stroke.
6—How to remove stock to a depth of 2 inches, to a limit of .0005".
7—A product that has been made for the last 11 years.
8—A product made by experienced molders.
9—Something said to be the last word in construction.
10—A point that has been emphasized.
11—How to keep your men on the job.
12—How to overcome poor threads and worn-out taps.

These are Correct Answers for List from Dec. 2nd Issue:

1—Federal Engineering Co., Ltd., Toronto, Ont.
2—Geometric Tool Co., New Haven, Conn.
3—Ritchey Supply Co., Toronto, Ont.
4—The Dunbar Brothers Co., Bristol, Conn.
5—The Roelofson Machine & Tool Co., Ltd., Toronto, Ont.
6—Wisconsin Electric Co., Racine, Wis.
7—The United States Electrical Tool Co., Cincinnati, Ohio.
8—Gooley & Edlund, Inc., Cortland, N.Y.
9—The Fisher Motor Co., Ltd., Orillia, Ont.
10—Canada Machinery Corporation, Galt, Ont.
11—Nicholson File Co., Port Hope, Ont.
12—Brown & Sharpe Mfg. Co., Providence, R.I.

Closing Date for This Contest is January 13th



WHAT OUR READERS THINK AND DO



The Design of Hinges and Hinge Pins

A Door Can Be Prevented From Sagging by First of All Determining "Are the Hinge Pins of Sufficient Strength"

By J. S. WATTS

WE have all seen machines of a neat and pleasing appearance spoiled by the doors being loose on their hinges, and hanging at a decided slope when opened, thus giving a worn out, dejected look to an otherwise good looking machine. It would seem that a few minutes of the designer's time, spent in making sure that the hinge pins load, without rapid wear, would be well repaid in the much better appearance of one with one long pin, for comparison. It will be noticed that the two pin arrangement allows the door to sag about twice as much as the one pin design, with the same slack. Moreover the two pin design tends to wear more rapidly than the other.

In the placing of the hinge bars, there are two ways in which these can be placed, as shown in Figures 2 and 3, respectively. If made as in Figure 2, it will be necessary, either to grind or machine the face of the hinge bar to get the door in place, or to leave sufficient clearance to allow for the roughness of the casting. This leaves a gap at "a" which is unsightly and becomes more so with wear. Making the hinges as shown in Figure 3 obviates this difficulty, and the fit becomes better with wear.

To determine the size of hinge pin, etc., is purely a matter of calculating the bearing surface required, as the pin will be of ample strength in other directions if the bearing surface is sufficient.

Referring to Figure 3, the weight acting through its centre of gravity has a leverage "b," while the hinge has a leverage equal to "c." The load "P," on the hinge pins, is therefore

$$P = \frac{W \times b}{c}.$$

and if we allow a maximum bearing pressure of seventy pounds per square inch we can expect the bearing to resist wear for a reasonable number of years. The diameter of the pin and the length of the bearing should be about equal to each other.

It is obvious that the greater we can make the length between the hinge bars "c," the lower will be the pressure on the pin, and the less the effect of the wear on the sagging of the door.

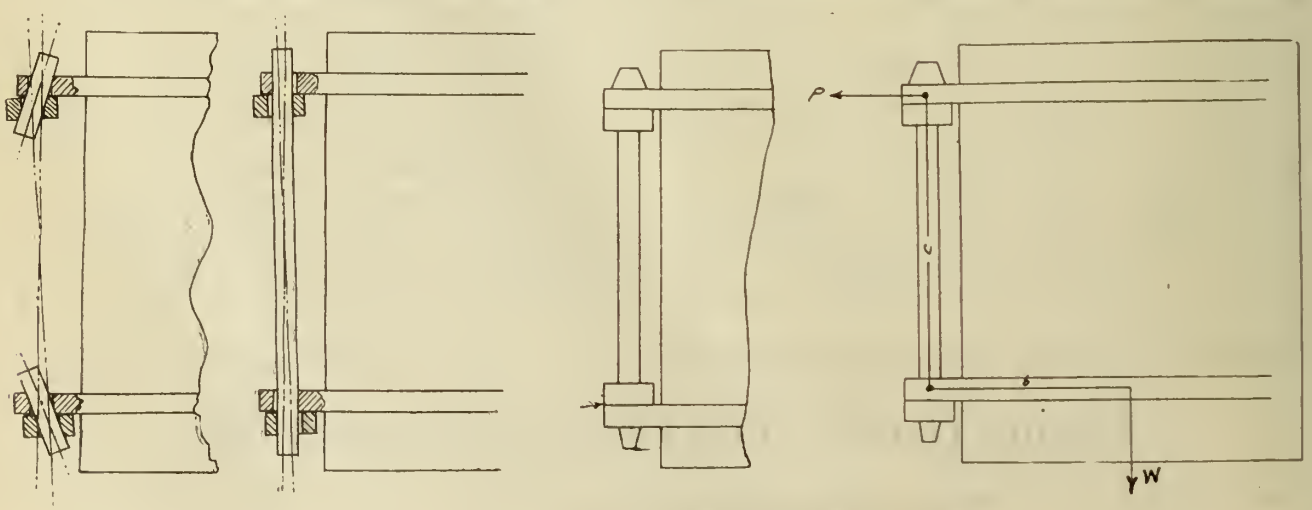
BROACHING ON THE DRILL PRESS

By Harry Moore

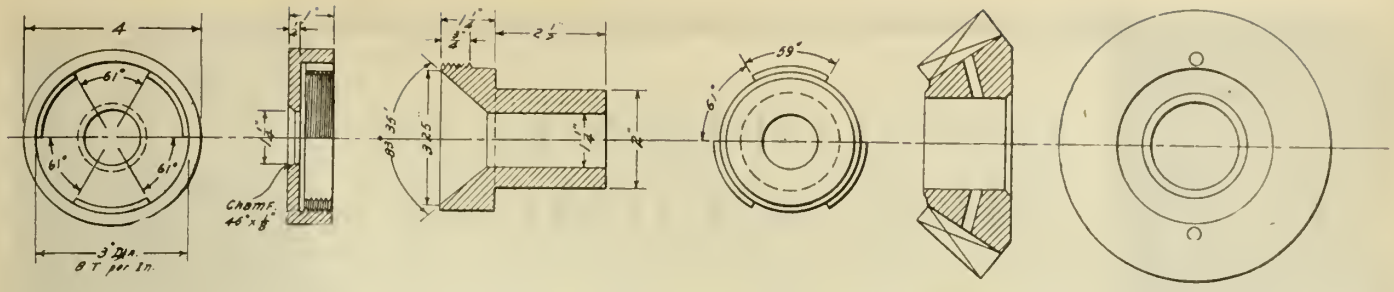
In shops where a limited amount of broaching is done the drill press is very often the broaching machine, and it is the purpose of this article to give some ideas on drill press broaching that may perhaps save many hours of experimenting. Keyways, both single and multiple, form common broaching operations, and therefore will be of interest to many readers. It is always good policy to drill out as much as possible of the keyway to be broached, and this can generally be done if the hole is not too long. In making a jig to drill out the semi-circular grooves, that will afterwards be broached, many mechanics make the bushings as shown at 1, relying on the bushing guiding the drill supported by grooves in the jig itself. This answers very well if only a few pieces are to be made, but the grooves wear out in time, become deeper and out of line, with the result that when the broach follows, it has too much metal to remove, and consequently, the work is not satisfactory.

A better method is shown in Fig. 2, where the bushing is extended to the bottom of the hole. It is a simple matter to replace the bushings when worn. The jig should be laid off and drilled first, then turned to the diameter of the hole in the work; the bushings are made solid and ground away after hardening.

Holding the broaches in drill press spindle is important for obtaining good



FIGS. 1 TO 3—ILLUSTRATING THE PRINCIPLES INVOLVED.



THE VARIOUS DETAILS OF THE CHUCK FOR THE BEVEL PINION.

results. The holder shown in Fig. 3 locates the broach (which is slotted at the top) and holds it lightly in place until it has passed through the work, when the withdrawal of the spindle will release it. The holder is provided with a small pin, behind which is a rubber pad or small spring, which keeps the pin pressed into a groove, thus preventing it dropping out when not in use. Broaching a long hole in the drill press can best be accomplished by using a bar with inserted blades, similar to a boring bar.

Since three or four of these blades will be needed it is essential to have some method of quickly changing them after each cut. The broach bar shown in Fig. 4 is designed with this object in view and answers the purpose admirably, since the only requirement is to keep the cutters central.

Fig. 5 shows the same bar adapted to cut four keyways. It will be noted that the bottom cutter locates the top one, and that by withdrawing the plunger the cutter can be removed, then the top one is free to slide out, providing a quick change; both cutters are slotted at the bottom as shown. The plate screwed to the bottom of the bar is slotted to allow the pin in the plunger to pass through, so that when the plunger is withdrawn it is given a slight turn, which keeps it out of the way while setting or removing the cutters.

It would take too much space to go into details regarding width of teeth, amount of clearance, etc., necessary on a push broach, but a good general rule is—do not try to remove too much stock at the one time, the longer the hole the less metal per tooth, also leave as much chip clearance as possible, for if these get crammed with cuttings before the broach is through, one of two things will happen—either the broach will break, or the path it has traveled since the cramming period will resemble a miniature trench more than a keyway.

The location of the work on the drill press will, of course, depend on the shape of it; simple jigs will nearly always accomplish the end desired. To do quick work, it is better to have both work and broach located, making sure also that spindle is securely locked. Do not allow the broach to fall through the center hole and crash into a soap box on the floor. A better method is to place a block of wood under the table, so that the broach will have only a slight drop after passing through the work. In this way the broach can be replaced in the spindle without sprawling under the table. This may seem obvious to many, but it is remarkable how many instances one comes across in the shope of otherwise well managed concerns, where, with a little thought and effort, a heart or back-breaking job could be transformed into a pleasure.

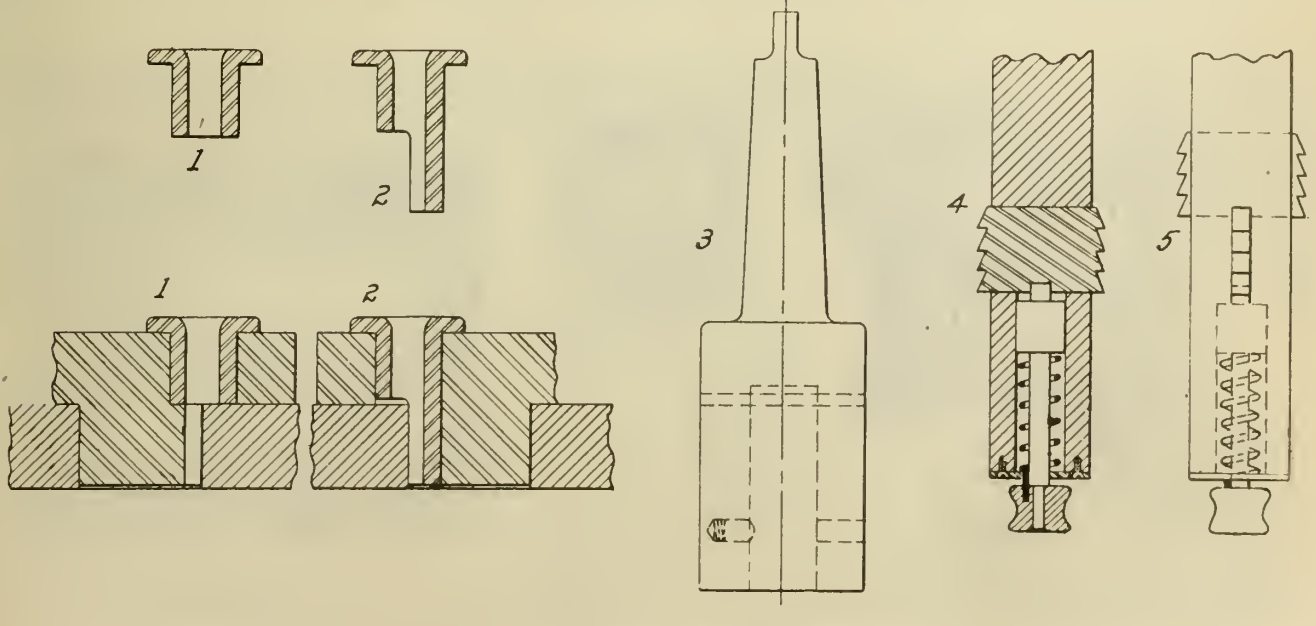
CHUCK FOR BEVEL PINIONS

By G. Blake

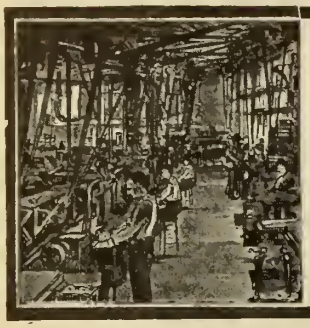
We had a large number of small bevel pinions to grind out in the bore, and as will be seen from the sketch they were not suitable for holding in a 3 or 4 jaw chuck, so the writer got out the special chuck as shown in the accompanying sketch.

The plain part was gripped in the ordinary 3 jaw chuck. The special feature of the idea was the quick handling and loading, which was accomplished by employing the interrupted thread method as is used on the breech block of a gun.

A small groove cut on the cap, and another on the body of the chuck, served as a guide for the operator, so as to enable him to put the cap on in the right place for the thread to engage. Much time was saved in handling the job in this manner and the machine used was a Heald internal grinder.



DETAIL VIEWS OF THE FIXTURE. REFER TO TEXT MATTER.



DEVELOPMENTS IN SHOP EQUIPMENT



OPTICAL MEASURING EQUIPMENT

The Van Keuren Co., 362 Cambridge Street, Boston, Mass., have sent us some interesting data regarding their optical measuring equipment and reference gauges. This optical equipment for the mechanical measurement of gauges by means of light waves is a new development, and is of worthy importance.

Take for example Fig. 1. This view depicts the optical measuring equipment, and this consists of a set of optical glass flats, and a source of monochromatic light, that is, light of one wave length or color.

An optical flat differs from a lens in that it has no magnifying power, but its utility consists solely in that it is a very accurate transparent flat test surface. Working flats 2 inches diameter by ⅝ inch thick are supplied, each having one surface accurately flat within 5 millionths of an inch. Only one of these is required for flatness tests, and the other two suffice for length measurements or comparisons.

One master flat, 2¾ inches in diameter by ⅞ inches thickness, with one surface accurately flat, within 2½ millionths of an inch, serves to complete the set of optical flats. Thus the two working flats and the master, can be proven absolutely by testing them against each other, employing the familiar principle that three surfaces fitting together in all combinations establish or originate flat surfaces. The master flat, in addition to its value for reference purposes, can be used on larger work than the working flats.

Monochromatic Light

The monochromatic light is a most practical arrangement specially designed for every day use. It consists of a conveniently constructed, finished oak box, provided with a tungsten filament lamp and a special selenium diffusing glass. This selenium diffusing glass cuts out all of the wave lengths of the violet, blue, green, yellow and orange light; and transmits only a very definite red wave length, resulting in an equivalent measuring unit of 8 dark interference bands to the ten thousandths of an inch or 12.5 millionths per band. Daylight, which results in merging colored bands with an average equivalent measuring unit of approximately 10 millionths per band is quite satisfactory for flatness tests. The monochromatic light is preferable for flatness tests and is particularly recommended for length measurements. It can be attached immediately to any alternating or direct current lamp socket.

The following rules must be observed when testing for flats:

1. To test a surface by interference bands it must be sufficiently well finished to reflect light. It should be clean and dry; and nicks or feather edges should be removed. The optical flat is then placed on the surface and with a slight pressure manipulated to bring the point of contact to the place desired and the bands a convenient distance apart (usually about ⅛ of an inch).

2. Straight bands indicate a flat surface. Curved bands indicate a curved surface. 3. In testing flatness with daylight, judge the straightness of the bands with reference to the distance between bands of like colors, and use an approximate measuring unit of 10 millionths per band. With the Van Keuren monochromatic light use the dark bands and an equivalent measuring unit of 12.5 millionths per band. 4. When the bands curve one-half the distance between their centre lines the surface is out of flat ½ unit. Other errors are in proportion to the amount of curvature.

5. When the centre of curvature of the bands is on the same side of the bands as the point of contact the surface being tested is convex—when on the opposite side it is concave. 6. The pronounced light spot indicates the point of contact.

7. When comparing two gauges for length as illustrated, they are of the same thickness or length when the bands on both gauges match each other. 8. When a series of straight bands occurs between two flat surfaces, there is al-



FIG. 1—THE OPTICAL MEASURING EQUIPMENT.



FIG. 2—A GROUP OF REFERENCE GAUGES.

ways a wedge of air between them. The bands run at right angles to the direction of the wedge. In comparing two gauges the shorter gauge will have its point of contact lower down on the wedge than the longer gauge, and the number of bands from the point of contact on the shorter gauge to the point of contact on the longer gauge indicates the number of units difference in length.

9. When the bands on two surfaces are parallel, the surfaces themselves are parallel. 10. When a flat gauge is properly wrung on a glass flat it is in contact within about 3 millionths of an inch, and no bands or colors occur.

Reference Gauges

The reference gauges shown on the other illustration are known as set R16. They are specially adapted to departmental and small shop requirements, and consist of five gauges, namely, 1-16 inch, ⅛ inch, ¼ inch, ½ inch, and 1 inch. Using these in various combinations makes available an accurate standard for every 1-16 of an inch. This set is said to be of particular value because it includes the great majority of stock sizes of drills, reamers, plugs, balls, tools, and drawing dimensions.

The flat faces establishing the standard of length are practically true surfaces, both for flatness and parallelism. The maximum variations of one or two millionths of an inch can be detected only with the aid of light waves, the most remarkable and modern measuring facility contributed by science.

A certificate showing the degree of perfection and the actual length measurements in millionths of an inch, compared by means of light waves, with authentic standards certified by the Bureau of Standards, Washington, D.C., is furnished with each set of reference gauges. Each gauge is held within a guaranteed accuracy of 10 millionths of an inch.

The contact face provided on the ⅞ inch diameter reference gauge has an area of .6 square inches. This is from 20 to 40 per cent. larger than usually provided on gauge blocks. A very important fact, however, is that experience has shown that these ⅞ inch diameter gauge blocks wear surprisingly uniformly flat and parallel. This is due to the fact that owing to their circular shape they are always wrung together in a different direction.

Expansion and Contraction

A 1-inch gauge block will expand 0.0000069 inch with a rise of temperature of one degree Fahrenheit. An equal length of iron or steel will expand from 0.0000058 inch to 0.0000072 inch depending upon the character of the material.

Thus, a tool or part made in accordance with these gauges, when the temperature is 80 degrees or 50 degrees, will contract or expand as the case may be almost the exact amount to bring the part being made correct at 68 degrees Fahrenheit, the standard temperature of measurement.

This automatic temperature control is of fundamental importance, for without it great difficulties would result.

TWO SPINDLE DRILL

The Black & Decker Mfg. Co., of Towson Heights, Baltimore, Md., has recently designed a two-spindle drill, specifically adapted for drilling holes necessary for the Murphy top fastener. This fastener is used for attaching automobile side curtains and when the base of the fastener is put on the automobile body, two holes ⅞ inch apart are necessary. This new machine drills these two holes the correct distance apart in the same operation.

The handle of the drill is like an automatic pistol and a pull on the trigger sets the two drill bits in motion. A second pull stops the drill and in this way the operator can control the tool without changing the position of either hand. The motor and the gear construction necessary for driving the two spindles is simple but rugged. The gears themselves are of the finest grade steel, heat treated. The two spindles have specially designed chucks to hold the two ⅛ inch drill bits.



GENERAL VIEW OF TWO-SPINDLE DRILL.

The tool is exceptionally light and by holding it in the natural way with the forefinger on the trigger the operator is able to drill two holes at the same time ⅛ inch in diameter and ⅞ inch apart.

COMBINATION DRILL AND REAMER

A tool that has been specially designed for use on jig work has been brought out by the Fastfeed Drill and Tool Company of New York City. This is a combination drill and reamer made of high-speed steel. The drill size is made about .010 to .015 inch below that of the reamer which is the desired size of the hole. The tool has four blades and they may be sharpened on the front edge as in the ordinary reamer. It is claimed that a high rate of production can be maintained with these tools. These tools can be obtained with shanks to fit any existing equipment.

SURFACE GRINDER

The Perfect Machine Co., Galt, Ont., have placed on the market a new surface grinder. This machine has a vertical travel of 8 inches, and is equipped with a table 18 inches by 8 inches, having a micrometer adjustment. The machine will take a 12-inch by 2-inch emery wheel, and is suitable for all kinds of surface grinding work.

They are also manufacturing a new 20-inch light type drill press that is equipped with both gear and power feed.

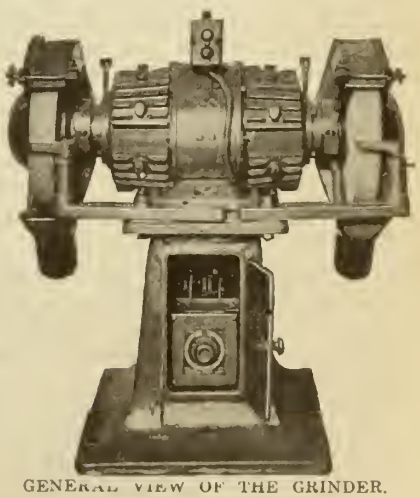
STRAIGHT-COLUMN INCLINABLE PRESS

Several interesting features are included in the recently designed straight side press brought out by the Toledo Machine and Tool Company of Toledo, Ohio. The press is direct motor driven and the motor pinion is always in mesh no matter what the inclination of the press. A special elevating screw is provided at the rear of the press for angular adjustment. The press may be furnished with or without gearing or other auxiliary equipment, and the frame may be designed to permit side feeding of the stock.

SELF-CONTAINED GRINDING MACHINE

The U. S. Tool Co., Cincinnati, Ohio, has recently placed on the market the self-contained tool-grinding machine shown in the illustration, ease of starting and total enclosure of the motor and control apparatus being features claimed by the maker.

The machine is equipped with a 5 h.p. shunt-wound, adjustable-speed Westinghouse motor running at from 1,120 to 1,600 r.p.m. on 230-volt direct current. The motor is started and stopped by a push button that controls a type C Westinghouse starter equipped with a speed-adjusting rheostat and located in the base of the machine. The push button is mounted on the top of the motor so that the workmen will not start the motor by jabbing the button with the material which they intend to grind, since it is easier to operate it by hand.



GENERAL VIEW OF THE GRINDER.

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A Christmas Message

CANADIAN MACHINERY extends to its readers its best wishes for a Merry Christmas.

"Just another year, another link,
To bind our friendship closer."

In this money-mad age we are apt to forget at times the real motive behind Christmas giving. It is a fact that a great section of the world has been so busy with grabbing and getting that it has had little time to pay much attention to the development of those finer traits that find expression in giving, and in considering the happiness and comfort of others.

It may clash with the teachings of certain radicals, both in the ranks of employers and employees, that it is a more wonderful thing to give than it is to receive. Despite this, that great old truth has stood for centuries and it will be here long after all the radicals, money-grabbers, agitators and the get-rich-quick group have passed on and been forgotten.

Christmas, 1920, finds the world rid of nearly all its war—finds nations, after months of skirmishing, still seriously considering the best way to weed out the chances of future wars through a combination of their resources and energies.

Things have not gone to the dogs, though there have been enough adverse currents to force them in that direction. The general bulk of business in this good land is still sweet and wholesome and showing signs that it is ready to sprout and grow into bigger and greater things in 1921.

To the advertisers in Canadian Machinery—we have appreciated your confidence during the year in our ability to carry your message to the industries of Canada and to distant parts of the Empire. We have tried to merit this appreciation by producing a paper that is sold to the readers on its merits, without premiums and without any inducement other than its educational and business value to the subscriber.

And so may your Christmas be a happy event, filled with kind deeds and inspiring thoughts, crowned with love and enriched with the sense and satisfaction of duty well performed and days profitably invested.

The Luxury Tax Off

THE removal of the Luxury Tax should help the machine tool business and many kindred fields indirectly. There has been so much tinkering with business in this country that the wonder is it has survived at all. Buying and selling, losing and making, have been twisted and bent out of form entirely, until one is forced to the conclusion that the more Government officials keep their hands off business in general the better for all concerned, especially for sound business itself.

The Luxury Tax did not directly touch the iron, steel and machine tool business, but it did touch the automobile business, and that is coming pretty close to the former, and it did touch many other lines, the stopping of which backed up on the tool and steel business in short order.

The machinery, iron, steel and metal working industries in this country need all the assistance they can get right now. They are buying from an admittedly high market and they are taking chances on selling into one equally as good as far as recovering their investment is concerned.

The manufacturer who is going ahead and doing his best to provide as much employment as possible is performing a far greater service than the class who are tub-thumping for tariff removals and decrying the importance of the manufacturer to the community.

Is This a Fair Practice?

OTTAWA reports indicate that complaints are still coming in that "freights on Canadian goods shipped from Canadian ports to Britain on Canadian lines are demanded in American instead of Canadian dollars. The Canadian Government Merchant Marine," continues the despatch, "has written to the Commissioner of Commerce that they have always made their freight collections in Canadian dollars. The complaints from Great Britain continue in regard to the practice of other lines demanding American dollars for Canadian service."

The report that the Canadian service never asks for payment in New York funds may be quite correct as far as present practice is concerned, but there are cases on record where it has been demanded, and bills of lading to this effect have been forwarded to the Department at Ottawa. Trade commissioners in various parts of the Old Land have complained several times about this practice.

Canadians are hurting their connections abroad by trying to nip in on American exchange when they have no right to do it.

If it is a Canadian product, shipped on a Canadian line to a country that is in no way connected with United States, it is hard to dig up a good excuse for adding a line to the effect that payment must be made in New York funds.

It is a short-sighted policy, and one that looks long and hard at a little present gain, rather than on developing and building for the future a trade that is going to continue to come back with its repeat orders in days when the business may be badly wanted.



MARKET DEVELOPMENTS



All the Markets Have Had A Quiet Week

Prices, Say Machine-Tool Builders, Are Not Going to Come Down as Costs are Still Up—Many Independent Mills Are Now Down for Lack of Orders—Carbon Drills are Marked Down.

DEALERS state that this time of the year should be rather dull even in normal times, and the machine tool trade will admit that these predictions are being fulfilled in this district. Nor is there any isolation in regard to the condition, New York reporting conditions much the same as here. The New York market is getting the worst of it from the standpoint of the dealers as a number of tools are being put out there for resale at figures well below lists. Yet the makers of machinery do not seem to be in the mood to be stampeded, as only this week several of them sent letters to their representatives in Canada that they were not making any changes in their selling prices. Their costs of production were not easing off, and that was the basis on which they were working, hence they could make no better selling prices than those already authorized. That, in brief, was the drift of the announcements.

Steel warehouses are quieter than they have been for some weeks past, although some of them claim a fairly good volume of trade. This may be accounted for in part by the fact that manufacturers prefer to draw from warehouse stocks rather than make up a mill tonnage themselves. So the warehouse trade cannot always be looked upon as a reliable barometer of business conditions.

Boiler tubes head the list of good sellers during this season. Most of the lake fleets are tied up now, and work starts at once on going over the equipment. Stocks are in good shape to supply all sorts of needs for this work, much better, in fact, than they have been for many months past.

Carbon drills were brought down by Canadian makers during the past week. They have been selling at 35 per cent. off the list, while the new price is 40 and 5 off.

The scrap market does not improve, nor do dealers see where any improvement is coming from. They refuse to buy except to fill contracts, stating that for the present they are out of the market.

MONTREAL GETTING IN SHAPE FOR THE DEVELOPMENTS OF 1921

Special to CANADIAN MACHINERY.

MONTREAL, December 23. — While here and there one hears the remark that business is good, the general impression is that quietness prevails, but of a character that would imply "the lull before the storm." The magnitude of the aftermath may be of small proportions, but the opinion is general that early in the New Year we will experience a partial return to more active participation on all sides in the development of industry and commercial activity. The C. P. R. management are taking advantage of the slack period and are closing the Angus shops for about two weeks, for the purpose of generally overhauling the plant and equipment. This is only one of the many instances where factory operations are being temporarily suspended to take inventory and make necessary repairs. In no small degree this has been reflected in the decline that has been noted in other lines of the metal industry.

Steel Movement Very Quiet

The steel situation continues to move along in the listless manner that has marked its movement for several weeks past, with such sufficient business passing to maintain the interest of dealers and producers, the consumers invariably being a passive spectator as to iron and steel activity. This does not mean that buyers are completely out of the market, but that their needs are gauged by the general requirements, and these have been materially reduced during recent weeks owing to the conservative policy that has been adopted on all sides. "The volume of business at the present time," remarked a dealer here, "is not of an encouraging character, but when conditions are taken into consideration, it is not surprising that this falling off in demand has developed. We are able now to get shipments from the mills almost as soon as the order is turned in, and, as a matter of fact, material previously on order is coming through in such quantities that our warehouse is beginning to take on a well stocked appearance. Some of this has been laid down at fairly high figures, while later quantities are coming in at more reasonable prices, so that in making sales we are able to equalize on material on hand. We are expecting some slight adjustment on some lines, as black sheets and plates, but believe that prices in general will hold comparatively firm."

Stock Taking Affecting Business

The fact that many industrial plants reserve the closing month of the year for their periodical stock taking has reacted on the business carried on, not alone in the plants directly affected, but also in other lines of activity that depend on co-operative enterprise for equalization of trade. Some shops throughout this district are taking this opportunity to readjust their operating staffs, and take a more than usual interest in the inventory of shop and equipment. "During the past week," stated one machinery dealer, "our representatives have been brought in touch with the stock taking phase of industry, where plants are practically closed to the outside world, as regards the purchase of material other than that required for absolute necessities. In some instances we are told that closing down is contemplated, for varying periods, for the purpose of taking stock and general readjustment of

working conditions. This attitude is the feature of present conditions and for the next few weeks will probably be the chief factor in industrial activity, or rather the lack of it." Asked as to the outlook for 1921, the dealer stated that he had every hope of a good year, slow at first but accelerating in the early spring. "With the gradual resumption of activity, which we anticipate early in the year, we may see a readjustment of prices, based on the new order of things as developed out of revised production costs, chief of which will be labor."

Buying at Low Ebb

The situation in old materials is still one where the interest of the dealer is hard to arouse. The consuming trade is almost nil and dealers are reluctant to take on any additional supplies in the hope of making a later sale. Present business is largely of the hand-to-mouth variety, where a direct transfer is made from seller to the buyer, through the dealer. Some light business is carried on regularly in meeting the needs of local foundries, but nothing of a special character has featured the scrap market for some time. "We are more than ordinarily quiet for this time of the year," said a dealer, "and we lay this to the readjustment that is taking place in many of the industrial plants throughout the country. Until this phase of industry has become more settled we are not looking for a renewal of active buying of scrap." Asked as to the possible duration of the slack period, the dealer would not commit himself, but the impression gathered was that before February there would likely be a gradual return to more active operations. In the absence of any marked movement of old materials dealers are satisfied to let quotations stand, as prices can only be based on individual sales. However, those quoted are the nominal average for the current week.

TRADE IS QUIET IN THIS DISTRICT

Makers Say They Are Not Changing Their Prices—Carbon Drills Are On a New Schedule

TORONTO.—If the removal of the luxury tax affects the machine tool business it will be in a reflex way, and will not be apparent for some time yet. The machine tool field is essentially in the class of essentials, and has not felt the tax as directly as many other lines. At the same time the removing of anything that will change the mental attitude of the buyer toward coming into the market to make purchases is going to work out to the good of trade in general.

Makers have not budged recently in the matter of prices. Such announcements as were going to be made came out some weeks ago, and since then the other makers have done nothing at all toward revising the selling schedules on which they are working. This morning one of the dealers showed this paper a letter which he had received from one of his principals, in which it was stated plainly that they had made no reduction in price, and were not contemplating making any reduction. The letter went on to point out that labor was not down yet, and there was no lessening of the cost of production or of carrying costs. This firm held that it would be a serious thing for the company to go out and make a cut in the price now. The dealer who received the letter said he was not particularly anxious to have any reduction made at this time. He was quite satisfied that were he to start out today with a reduced list on his lines he could not use it to advantage. That feeling seems to be general, although one of the Toronto men in the machine tool business remarked this morning that it had often been the case, in his experience, when there was considerable talk about there being no drop in prices, the change came.

Hard to Sell Here?

"It is a hard market in which to sell machine tools on the basis of performance," was the complaint of one dealer this morning. "I may be wrong in the firms I work with, but in many cases I find that after going thoroughly into the working details with a man who is interested in a machine tool, and showing him where he will be money ahead every day by putting in the new equipment, he will buy a machine for less money. Many of the firms talk about going in for export trade, but I believe that they will have to manufacture to better advantage before they ever make much of a success in this line. It is one of the most discouraging things a machine tool salesman can run into, viz., trying to sell on a good sound basis, only to find that you lose ground many times by following this method."

A Quiet Month in Warehouses

Warehouse trade in steel business is quiet this month. It is in almost any year, and dealers are not prepared to state what percentage of their lessened trade can be blamed to seasonable conditions. It used to be said that steel was a good market barometer, but there are some exceptions, and the warehouse business is one of them, in that it may be very good while industry in general may be very quiet. Right now there are quite a number of firms in the country that are not buying for stock but drawing on the warehouses instead. This brings quite a bit of trading to the warehouse, but it does not mean that any more goods are being turned out, because the manufacturer in many cases would rather buy in small lots from the warehouse than make up a tonnage good enough to be forwarded to the mills in the ordinary way. Thus mills and factories may be operating at a very small percentage of their capacity and the warehouses may be quite busy supplying business that does not come to them at all when these same customers

POINTS IN WEEK'S MARKETING NOTES

The machine tool market in New York continues to be remarkably dull, and a number of makers are closing down their plants for the holiday season.

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Many new machine tools are being offered by the United States manufacturers at a reduction from list prices. They have bought more equipment than they see use for now and are anxious to get rid of it even at a loss.

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The price of carbon drills has been reduced in Canada. The old price was 35 per cent. off the list, while now the selling price is 40 and 5 off.

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Some machinery dealers in this district have received word from their principals during the past week that they have no intention of reducing prices, as their costs are still too high to permit of any such action.

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The steel warehouses are still doing a fair amount of business, as many manufacturers prefer to draw from the stocks in these places for actual wants rather than to make up a mill tonnage under present conditions.

—

Boiler tubes are the bright spot in the steel market just now, as many of the lake fleets are tying up for the season and will immediately undergo repairs.

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The scrap metal market is exactly where it was a week ago. Dealers in this district are refusing to buy except against contracts.

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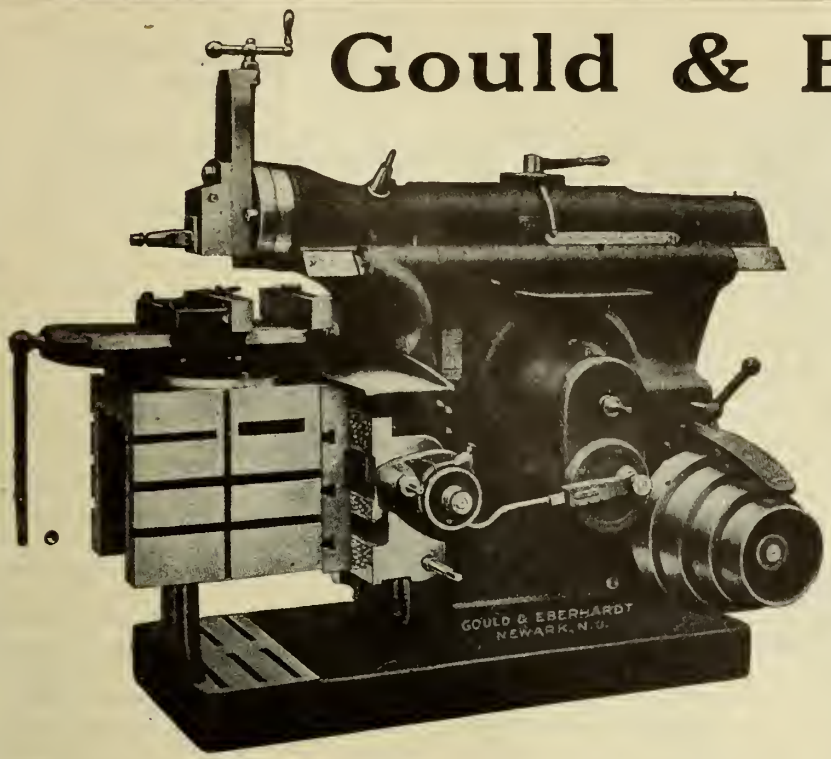
Pittsburgh reports state that a number of the smaller independent mills are closed entirely, and that the operating average of them all is not much over 35 per cent. of capacity.

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Some reports have it that one of the next developments will see the independents cutting the Corporation prices.

—

There is very little business being done in pig iron at any of the furnaces, and reports from blast furnace centers indicate that some of the stacks are blowing out.



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are busy enough to warrant them placing mill tonnages for building up their own stocks.

Canadian warehousemen, it is claimed, cannot make as much on their turnover as the warehouses in United States. By the time the steel is laid down here they are up against a much higher cost than the U. S. warehouse and cannot recover proportionately as large an amount from the consumer.

Yards Not Busy Now

Apparently many of the warehouses are finding difficulty in keeping their men busy in the yards and shipping departments. There is not the volume of business moving there was a few months ago, although up to date there have been very few cases where men have been let out. A number of the dealers mentioned this and the chances are that some action may be taken toward making a reduction in hours or days of employment until there is some improvement.

Tubes are the brightest spot in the business now. Fleets are tying up for the winter at a good many of the lake ports, and that replacement and repair business is starting to come in nicely now. There is a good assortment of tubes on hand, much better than several months ago, when it was a difficult matter to keep all the wanted sizes in stock.

Carbon Drills Down a Little

A change was made in the selling price of carbon drills, the new price becoming effective the 20th of the month. These have been selling at 35% off the list for some time now, but the new price is 40 and 5 off. It works out about like this. Take a one-inch drill which is listed at $3.50, with 35 off would mean a price of $2.28 to the buyer. Now it will mean with 40 and 5 off, a price of $2 to the user. All the Canadian makers have adopted the new price.

There is a fair amount of "pick-up" business going now, but the average order is not very large. The National Railways have a requisition out now for some small tools.

No Improvement Here

The scrap metal market is just where it was last week. There is only contract dealing going on, and that is in very limited volume. The yards are still very much disinclined to take on any material and they are assuming the same attitude as formerly, viz., that they are absolutely out of the market, and they want it clearly understood that any prices they are responsible for quoting in print are purely nominal.

THE INDEPENDENTS MAY CUT THE PRICE IN EFFORT TO GET ORDERS

Special to CANADIAN MACHINERY.

PITTSBURG, December 23.—There has been a still more impressive decrease in the operations of the independent steel interests. One large independent is reported to be operating only three of its twelve blast furnaces, with steel making departments slowed down almost as much. Not a few of the smaller mills are closed entirely. The operating rate for the independents as a whole probably does not average over 35 per cent. and the common prediction is that by the first week in January the independents will be down to practically nothing.

This condition does not indicate that steel consumption has ceased by any means, for the United States Steel Corporation, instead of making less steel than formerly, is making more. The corporation is operating 91 per cent. of its steel ingot capacity, against 88 per cent. two or three weeks ago. It is not on account of increased pressure upon it for deliveries that the corporation has lately increased its production, but because it can now do so. For more than a year the corporation has been endeavoring to produce all the steel possible, and lately, with the loosening up of the trade situation, it has better supplies of coal and coke whereby it has been enabled to blow in some blast furnaces that had been idle perforce.

When the Steel Corporation operates at 91 per cent. of capacity, which is approximately 23,000,000 gross tons a year, it is producing at the rate of 21,000,000 tons a year. During the first ten months of this year production by the industry as a whole averaged a rate of 42,000,000 tons a year, there being only relatively minor variations, in individual months, from this rate. Thus the Steel Corporation is now producing one-half as much steel as was formerly produced by the whole industry. Beyond question the consumption of steel has greatly decreased, and thus there is left little business for the independents. It is not a case of the Steel Corporation taking business away from the independents, but one of the corporation having previously booked the business, when the independents were charging high prices and buyers would patronize them only for early deliveries. Many consumers were buying both from the corporation and from independents and now, with reduced requirements, they can get along with their Steel Corporation deliveries.

There is an interesting aspect to this alignment. For years there has been a question whether or not the Steel Corporation is a "trust." In the suit of the Government, the Supreme Court decided in favor of the corporation, but by a narrow margin, and the matter was left in such shape that if the corporation should alter its policy there would be ground for re-opening the case. It has been quite a common view that the Steel Corporation should keep its proportion of the total capacity under 50 per cent. The corporation is on the safe side in that, for at the outside, its capacity, measured by steel ingots, is only 44 per cent. of the total. Obviously there can be no harm in the corporation making more steel than its "proportion" if it does so by letting the public have the steel at lower prices than the independents ask. Last year the corporation made 51 per cent. of the steel, instead of 44 per cent., this year there will be something of the same sort, and if present conditions continue any length of time the corporation will show a very high percentage of next year's production. Nobody could complain about that unless it would be the independents, and they would hardly be able to find a point of law on which to hang such a complaint.

Strip Steel Lower

The mills have made additional reductions in strip steel, following those of a fortnight ago. At that time the nominal prices were 5c for hot rolled and 8c for cold rolled, but the open market as shown by a few sales was half a cent less. The reduction was to 4c and 7c, respectively. The present reduction is to 3.30c for hot rolled and 6.25c for cold rolled. Strip steel had scored much heavier advances than other rolled steel products, except sheets, the reason no doubt being that the automobile industry played such a large part, and the automobile factories were quite reckless earlier in the year in bidding for steel. The new prices, however, are really in keeping with the general steel schedule. The 3.30c price for hot rolled strip steel is simply the standard price of 3.05c for hoops, plus an extra or advance of 25 cents per 100 pounds for the quality, including accuracy, surface finish and stamping quality. Under the war control there were two extras, one of 25 cents per 100 pounds, over the hoop and band base price of 3.50c for "stamping quality," and one of 50 cents for "deep stamping quality." Now no distinction is made, all hoops being regarded as "deep stamping," and the material is simply called hot rolled strip at 3.30c instead of 3.05c, base, plus 25c extra for stamping quality.

Steel Prices Steady

At various times recently the independent market on tin plate, bars, shapes, plates, wire products and sheets declined to the Steel Corporation level. Pipe did not decline, and has not declined to date, the independent list being $7 to $10 a ton above the Steel Corporation prices, these being on a list with a basing discount of 57½ per cent. As the independent pipe mills have been receiving lately a few cancellations and a great many postponements or suspensions they will probably have to drop within a short time.

In the commodities in which the independent market has declined to the Steel Corporation level, no important shading has as yet appeared, although it is a common expectation that in due course some of the independents will cut the corporation prices. There is, of course, some quoting by western mills that technically represent price cutting, but the common view of this is that it is simply an ignoring of the "Pittsburg base," mills naming delivered prices that represent less than the regular Pittsburgh price, plus rail freight from Pittsburgh to destination, but a higher net price f. o. b. the mill than the Pittsburgh price. Particularly with the advanced freight rates in effect since August 26 there is a natural disposition, when orders are scarce, for the removed mills to ignore the Pittsburgh base.

The pig iron market remains stagnant. Nominal prices remain: Bessemer, 35c; basic, $33; foundry, $35, f.o.b. valley furnaces, freight to Pittsburgh being $1.96. There is no incentive to furnaces to reduce these prices as there is no inquiry, hence no opportunity for competition. Next month will probably see some declines, possibly to $30 for basic and foundry and $32 for Bessemer, but there may not be enough furnaces in blast for any actual reductions to occur. Only a third or a fourth of the valley merchant furnaces are now in blast, and these may not stay in.

While furnaces in general have been indisposed to contract for Connellsville coke for the half year, feeling that they do not know whether they are going to run and that the coke operators are not yet down to their lowest terms, a fair amount of business has gone through in the past week or two, involving perhaps 75,000 tons a month, but of course on a "requirement" basis, so that if the furnaces do not run they are under no obligations. All the business was closed on a ratio of 5 to 1 against basic pig iron at valley furnaces. If basic iron, now $33, is $30, something not at all improbable, the coke will be invoiced at $6 month by month until there is a change in pig iron. The contracts generally have a minimum below which coke cannot go, irrespective of pig iron, and some at least provide for a stiffer ratio in case pig iron advances above a certain point.

Spot coke is $5.50 to $6 for furnace, and $7 to $7.50 for foundry, per net ton at ovens, Connellsville region, though some particularly well known brands of foundry coke command more. Three important producers of foundry coke are quoting on first half contracts $10, $9 and $8.50, respectively, but none of them is booking any business of consequence.

NEW YORK HAS A VERY QUIET WEEK

And Tool Makers are not Likely to Operate Their Plants at Full Capacity

Special to CANADIAN MACHINERY.

NEW YORK, December 23.—The year is drawing to a close with no improvement in the machine-tool business, but eyes are eagerly turned toward the new year, when at least a modicum of betterment is expected. Some in the trade are not sanguine that there will be any marked increase in sales for several months, but it does not seem possible that conditions as dull as those which have prevailed during November and December can continue for long. December sales of some concerns in the trade scarcely provide for postage stamps.

New machine-tools are appearing on the market in increasing numbers and must be absorbed before there is substantial buying from the manufacturers. Many of the tools are being offered at sacrifice prices. A large company has placed on sale about 125 standard machines, many of which have never been removed from shipping crates, and at prices about 25 per cent. below those today quoted by the makers. Some companies overbought and are now anxious to dispose of their surplus equipment, even at a loss.

Most machine-tool plants will operate at a low rate over the holiday period and some will shut down entirely for a week or more.

GEOMETRIC

Adjustable Collapsing Taps

Have overcome all the expense and annoyance of tapping screw threads with a solid tap.

Anyone doing thread tapping knows what backing out a solid tap each time means. It usually means low production, poor threads, and worn-out taps.

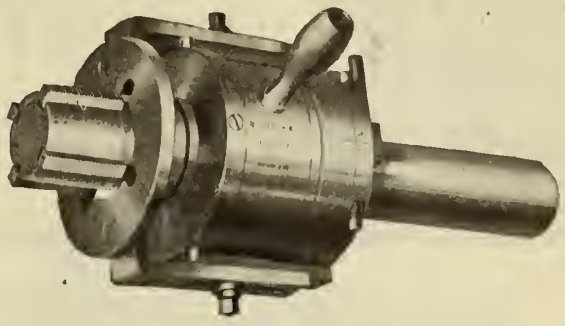
The mechanism of the Geometric Taps takes care of adjustment to correct diameter each time a thread is tapped, it collapses the chasers automatically, leaving a thread clean cut and perfect.

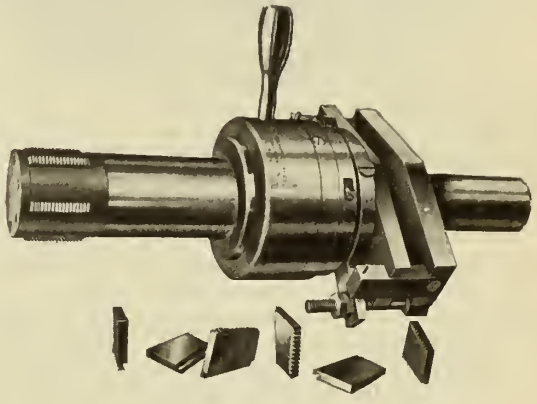
The chasers are readily reground, and when finally used up, are renewed at comparatively small cost, leaving the tap as efficient as when new.

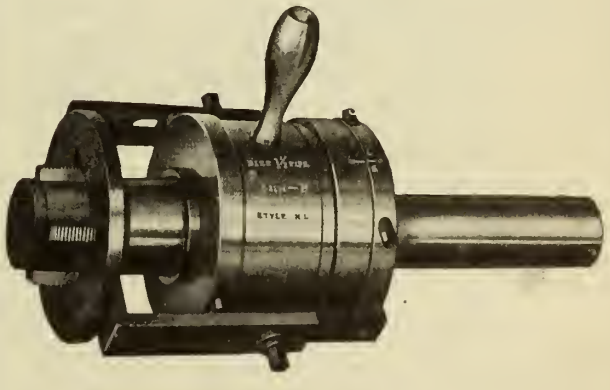
The manufacturers of the Geometric line of Collapsing Taps and Self-opening Die Heads are justly proud of the distinction which is theirs: —

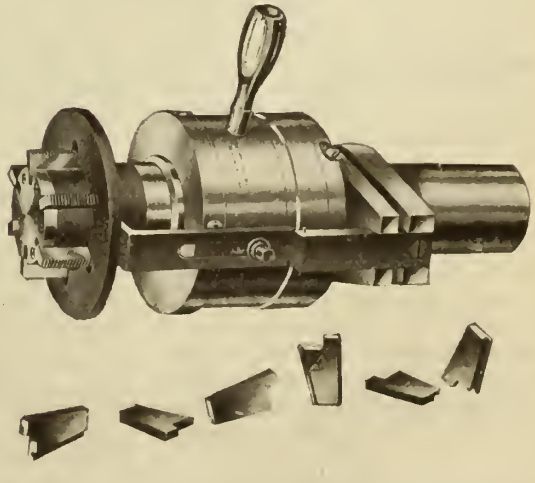
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If interested tear out this page and place with letters to be answered.



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES



Montreal

H. L. Peiler, manager of the Mason Regulator Company, has just returned from a very successful business trip in the Eastern Provinces.

P. L. Pratley, M.E.I.C., mechanical engineer of Montreal, has been awarded the Telford gold medal of the Institute of Civil Engineers (Great Britain) for his paper on the "Design and Erection of the St. John Arch."

Announcement has been made to the effect that the Angus shops of the C.P.R. in Montreal will be closed down for a period of about twelve days, for the annual overhauling of the plant and a more than ordinary stock taking of the shops and equipment. Quite a number of men will be required to carry on the work of overhauling, but about 5,500 men will be laid off temporarily until the resumption of operations on the 3rd of January. As stated by Grant Hall, vice-president of the Canadian Pacific, this was not in the nature of a lay-off of the men, but "as the period is thought to be the time which would cause the least inconvenience to the workmen, as the Christmas season and New Year's festivities always make work more or less intermittent."

Walter T. Newman, secretary of the British Smelting & Refining Co., Limited, Montreal, sailed for London at the request of the principals of this firm. The object of his visit will be to attend a joint conference between the Montreal and London head offices, which is to draw up a programme of expansion for 1921. Mr. Newman takes with him a report of the progress of the Canadian Company, which has been very gratifying.

Engineering

Wallaceburg, Ontario, is preparing to build a memorial hospital.

Plans are under way for the erection of a memorial hall at Hamilton, Ont.

The School Board at St. Godfroi, Que., contemplates building a new school.

The Island Amateur Association plans the erection of a club house at Toronto Island.

The erection of a $50,000 mausoleum is projected at Stratford, Ont. Address Ald. C. L. Meyers.

The following companies were incorporated during the week: A. J. Roach Co., of Canada, Ltd., Toronto, $250,000; A. G. Spalding & Bros. of Canada, Ltd., Toronto, $300,000.

The work on an addition to Beatty Bros.' plant in Chelsea Green, London, Ont., will be commenced soon.

The erection of a temple is planned by Mocha Temple of the Masonic Order of Mystic Shriners, London, Ont.

Rumor states that the Provincial Government may erect a pulp and paper mill in Northern Ontario.

The L. R. Steel Service Corporation, of Buffalo, has purchased the McGreevy Block, Winnipeg, Man.

A memorial convocation hall is planned by the University of New Brunswick, Fredericton, N.B., at a cost of $250,000.

The Federal Government are contemplating the erection of a hospital costing $100,000 at Gross Isle, Quebec.

A fifteen-acre site has been purchased by Campion College, Regina, for the erection of a college building to cost $100,000.

Plans have been prepared by the McLachlin Bros., Ltd., Arnprior, Ont., for the construction of a new pulp mill; also a dam for the development of 2,000 h.p.

Plans are being prepared by W. G. Murray, architect, Dominion Savings Bldg., for the remodelment of school to cost $10,000, at London, Ont.

Work will be started in the spring at London, Ont., on the erection of factory extensions costing $200,000 for Beatty Bros., Fergus, Ont.

The general contract for alterations to the Salvation Army Home, Merrick St., Hamilton, has been awarded to D. H. Evenden, 31 St. Matthews Ave.

A factory costing about $20,000 is being planned by the B. C. Silica & Talc Co., Burnaby, B.C. The site is to be on the north arm of the Fraser River.

E. D. Vernon, architect, Truro, N.S., is preparing plans for a new $100,000 school. It is expected that construction will be proceeded with in the spring.

It has been announced by Hon. Manning Doherty, Provincial Minister of Agriculture, that the Ontario Government has decided to build a new dairy building in connection with the Ontario Agricultural College.

Luney Bros., of Victoria, B.C., have received the contract for the construction of the $250,000 Capitol Theatre, to be built for the Paramount-Victoria Theatres, Ltd., at the corner of Yates and Blanshard Streets, Victoria.

Fulton Motors, Ltd., Farmingdale, Long Island, have decided to locate their Canadian plant at Welland. The property of the Canadian Automatic Transportation Co. on Ontario Road has been secured and additional buildings will be erected.

Plans are being prepared by J. W. Siddall, architect, Confederation Life Bldg., Toronto, for community club for Northcliffe Club. Building will contain a swimming pool, dining room and dance hall. Bowling greens and tennis court will be provided for.

Twizell, Birds & Twizell, architects, 719 Metropolitan Bldg., Vancouver, are preparing plans for an eight-room wing of what will eventually be a sixteen-room school. It is estimated that this wing will cost $100,000. It has not been decided yet whether tenders will be called or work done by day labor.

FIRMS WANTING TO ESTABLISH TRADE RELATIONS WITH CANADA

Information regarding the following lines can be obtained by communicating with this paper and mentioning key numbers.

2567-2569. **Iron and Steel.** Three British firms in Constantinople with extensive connections desire to receive particulars from Canadian suppliers of iron and steel with a view to future developments of this trade.

2570-2572. **Iron and Steel.** A firm of merchants and commission agents in Constantinople desire to receive particulars from Canadian exporters of iron and steel.

2565. **Tools.** A firm of merchants and commission agents in Constantinople desire to receive particulars from Canadian exporters of all kinds of tools.

2576. **Belting.** A Nottingham firm are prepared to consider offers of leather belting.

Coal for Newfoundland.—Active steps are being taken toward the development of one of the bituminous coal areas which have been known to exist for a long period in Newfoundland.

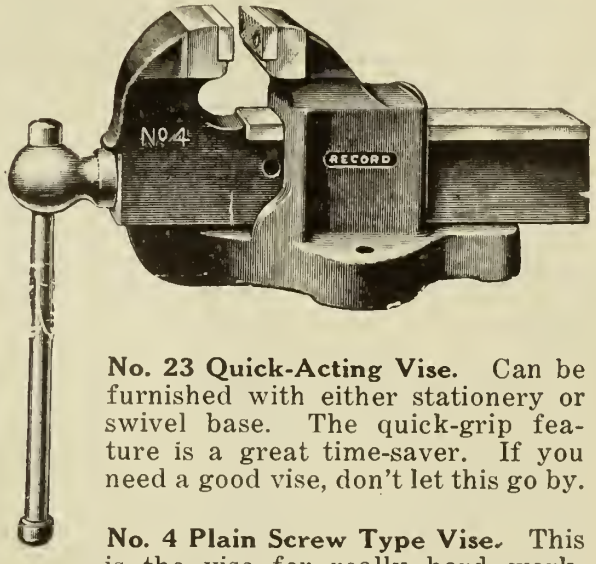
Aikenhead's

Canada's Leading Tool Supply House

When you want tools—remember Aikenhead's Tools—their reliability under severe strains, standard quality and modern design, assure maximum service at minimum upkeep cost. Immediate shipments on all orders. Let us know your requirements.

"Record"
Mechanics' Vises

HERE is your opportunity to secure a high grade English Vise at a remarkably low price. "Record" Mechanics' Vises are strong, reliable tools. They are made of the best grey iron castings and will stand the roughest abuse. Send for price list.

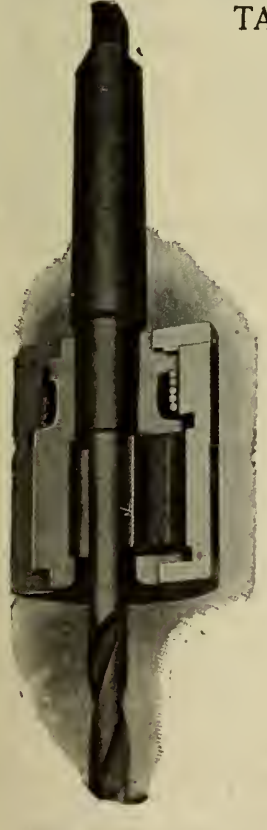


No. 23 Quick-Acting Vise. Can be furnished with either stationery or swivel base. The quick-grip feature is a great time-saver. If you need a good vise, don't let this go by.

No. 4 Plain Screw Type Vise. This is the vise for really hard work. Equipped with Stationary base only.

Aikenhead's

Holds Tools with or without TANGS



The Wahlstrom Chuck
This AUTOMATIC Drill Chuck Never Slips

THE clutch of the Wahlstrom positively cannot slip. Its instant-acting jaws close on the entire shank with a grip that becomes firmer and firmer as the resistance to the tool increases.

There's no time lost in waste motion with the Wahlstrom Chuck. It is Automatic and instantaneous in action. Two seconds is all you need to change from drilling to reaming, counterboring or tapping—and you don't stop the spindle.

In addition to regular drill press work they will increase production of lathes for burring, turning, filing, etc.

Made in two different styles. One style holds No. 1, 2 or 3 Morse Taper Shank Drills—with or without a tang. The other style is made in three sizes, which hold all sizs of straight shank tools from 1-4 to 1-inch.

Give your men this keyless and colletless chuck.
Results will prove it pays.
Sent on trial.

Aikenhead Hardware Limited
17 Temperance St., TORONTO

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$39 96
Lake Superior, charcoal, Chicago	53 50
Standard low phos., Philadelphia	44 79
Bessemer, Pittsburgh	41 96
Basic, Valley furnace	37 50
Toronto price:—	
Silicon, 2.25% to 2.75%	51 50
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 00
Steel bars, base, Toronto	5 00
Iron bars, base, Montreal	5 00
Steel bars, base, Montreal	5 00
Reinforcing bars, base	5 50
Steel hoops	6 00
Tire steel	5 00
Spring steel	8 00
Band steel, No. 10 gauge and 3-16 in. base	5 50
Chequered floor plate, 3-16 in.	8 50
Chequered floor plate, ¼ in.	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	3 50
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	5 50
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 67 to 5 50
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58½	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

METALS

	Gross. Montreal	Toronto
Lake copper	$19 00	$19 50
Electric copper	18 50	19 00
Castings, copper	18 00	19 00
Tin	44 00	46 00
Spelter	8 50	9 00
Lead	7 50	8 00
Antimony	8 00	9 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 6 50	$ 6 00
Plates, ¼ up	6 00	5 50

PIPE—WROUGHT

Standard Buttweld Pipe

Per 100 Ft.

	Steel Blk.	Steel Galv.	Gen. Wrought Iron Blk.	Gen. Wrought Iron Galv.
⅛	$ 6 50	$ 8 50	$.....	$.....
¼	5 31	7 41	5 91	8 01
⅜	5 31	7 41	6 91	8 01
½	7 10	8 63	7 95	9 48
¾	8 80	10 87	9 95	12 02
1	13 01	16 07	14 71	17 77
1¼	17 60	21 74	19 90	24 04
1½	21 04	25 99	23 79	28 74
2	28 31	34 97	32 01	38 67
2½	44 75	55 28	....	....
3	58 52	72 29	....	....
3½	74 06	90 62	....	....
4	87 75	107 37	....	....

Standard Lapweld Pipe

Per 100 Ft.

	Steel Blk.	Steel Galv.	Gen. Wrought Iron Blk.	Gen. Wrought Iron Galv.
2	$32 01	$ 38 67	$35 71	$42 37
2½	48 26	58 79	54 11	64 64
3	63 11	76 88	70 76	84 53
3½	75 90	92 46	85 10	101 66
4	89 93	107 55	100 83	120 45
4½	1 05	1 29	1 30	1 54
5	1 22	1 50	1 52	1 80
6	1 58	1 95	1 97	2 33
7	2 06	2 53	2 53	3 01
8L	2 16	2 66	2 66	3 16
8	2 49	3 07	3 07	3 64
9	2 98	3 67	3 67	4 36
10L	2 77	3 41	3 41	4 05
10	3 56	4 39	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.

4½" and larger, 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%.

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$10 50	$10 50
Copper, crucible	13 00	12 00
Copper, heavy	12 50	12 00
Copper wire	12 50	12 00
No. 1 machine composition	13 00	12 00
New brass cuttings	7 00	9 00
Red brass turnings	10 00	10 00
Yellow brass turnings	7 00	7 50
Light brass	5 00	5 00
Medium brass	6 50	6 00
Scrap zinc	5 00	5 50
Heavy lead	5 25	5 60
Tea lead	2 50	3 00
Aluminum	16 00	16 00

	Per Ton	Gross
Boiler plate	$11 00	$12 00
Heavy melting steel	18 00	23 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	20 00	25 00
No. 1 machine cast iron	32 00	33 00
Pipe, wrought	8 50	10 00
Car wheel	30 00	33 00
Steel axles	20 00	20 00
Mach. shop turnings	8 00	9 00
Stove plate	23 00	25 00
Cast boring	8 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	+10
Carriage bolts, ⅜-in. and less	Net
Coach and lag screws	—15
Stove bolts	55
Wrought washers	—25
Elevator bolts	+10
Machine bolts, 7-16 and over	+10
Machine bolts, ⅜-in. and less	+10
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 50
Nuts, hex., tapped	add 3 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	—20% 25 and 5
Sq. and hex. hd. cap screws	12½
Rd. and fil. hd. cap screws	plus 25
Flat but. hd. cap screws	plus 50
Fin. and semi-fin. nuts up to 1-in.	12½
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	—5
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	+12½
Studs	+5
Taper pins	—12½
Coupling bolts	+40
Planer head bolts, without fillet, list	+45
Planer head bolts, with fillet, list plus 10 and	+55
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	+60
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add +85
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails, base	$6 10
Cut nails, base	7 00
Miscellaneous wire nails	50%

ROPE AND PACKINGS

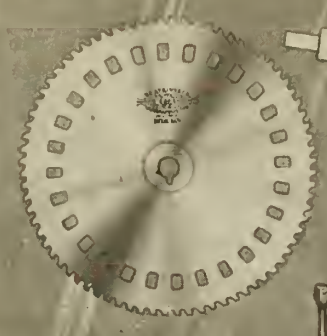
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28

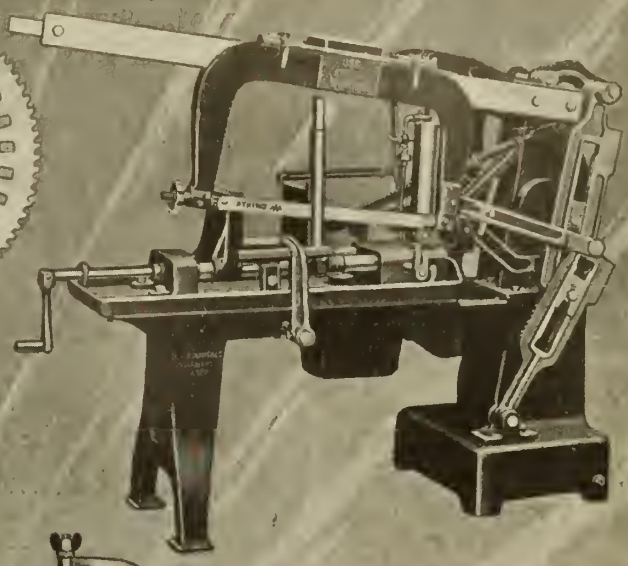
POLISHED DRILL ROD

Discount off list, Montreal and Toronto ..... net

ATKINS STERLING QUALITY SAWS







O'er Land and Sea
North South East West

Atkins Sterling Quality Saws

are noted for their efficiency. Their use will increase your production.

Ask for new literature describing Atkins Kwik Kut Power Hack Saw and Metal Cutting Band Saw Machines, Circular Metal Cutting Saws, AAA Hack Saw Blades and Frames, etc.

"A Better Saw For Every Use"

Write for Catalog

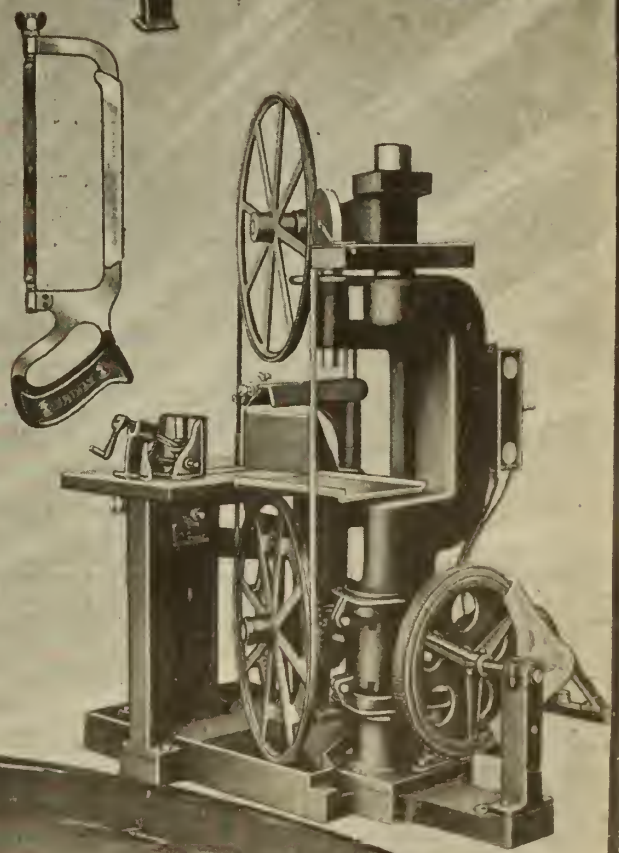
E. C. Atkins & Co.

Established 1857

"The Sterling Quality Saw People"

Factory: HAMILTON, ONT.

Branch: VANCOUVER, B. C.





MISCELLANEOUS

Solder, strictly	$ 0 28½
Solder, guaranteed	0 30½
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	20 35
Red dry lead, 100-lb. kegs, per cwt.	15 00
Gasoline, per gal., bulk	0 42
Pure turp., single bbls., gal.	3 15
Linseed oil, raw, single bbls.	2 37
Linseed oil, boiled, single bbls.	2 40
Wood alcohol, per gal.	4 00
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S.S. drills, wire size	40 and 5
Can. carbon cutters, plus	10
Standard drills, all sizes	40 and 5
3-fluted drills, plus	10
Jobbers' and letter sizes	40 and 5
Bit stock	50
Ratchet drills	10
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers, carbon	50
Centre reamers	5
Chucking reamers	net
Hand reamers	10
High speed drills, list net to plus	20
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7.50 base
Hexagons and flats	7.50 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	70	85
Class B	30	40
Class C	20	30

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 9 25	$ 9 00
Sheets, blue ann., No. 10	7 75	7 50
Canada plates, dull, 52 sheets	13 00	13 00
Can. plates, all bright	14 00	.....
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	13 00	.....
Fleur-de-Lis, 28 B.W.G.	12 50	.....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	11 00
Premier, 10¾-oz.	11 50	11 40
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	35 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	..
Royalite, per gal., bulk	29½
Palacine	32½
Machine oil, per gal.	65
Black oil, per gal.	34
Cylinder oil, Capital	1.01
Petroleum fuel oil, bbls., net	19

BELTING—No 1 OAK TANNED

Extra heavy, single and double	6½
Standard	6½
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 30
Brass sheets, 24 gauge and heavier, base	0 38
Brass tubing, seamless	0 42
Copper tubing, seamless	0 44

WASTE

XXX Extra	.23	Atlas	.19
Peerless	.22	X Empire	.18½
Grand	.21½	Ideal	.18
Superior	.21½	X Press	.17
X L C R	.20		

Colored

Lion	.16	Popular	.12
Standard	.14	Keen	.10
No. 1	.14		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.20	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$35 00	$37 00
Copper wire, list plus 10..		
Plain sheets, 14 oz., 14x60 in.	40 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	43 00	46 00
Copper sheet, planished, 16 oz. base	47 00	50 00
Braziers', in sheets, 6 x 4 base	39 00	42 00

LEAD SHEETS

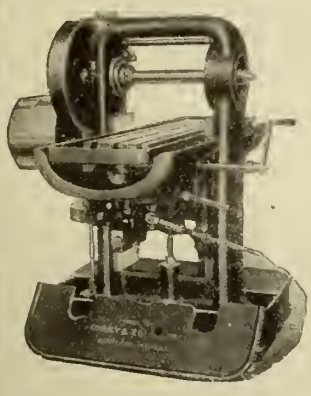
	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 50	$14 50
Sheets, 3½ lbs. sq. ft.	10 25	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 00	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

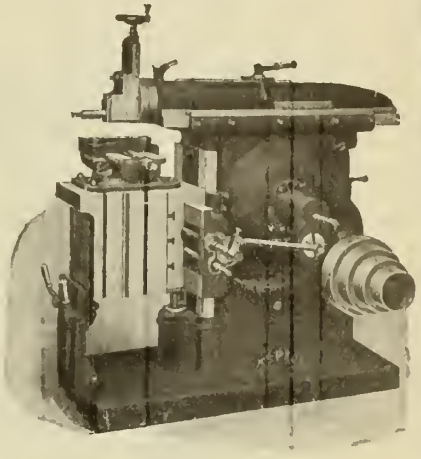
Acid, boracic	$ .23
Acid, hydrochloric	.04¾
Acid, nitric	.11
Acid, sulphuric	.04½
Ammonia, aqua	.15¾
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.16
Copper, carbonate, annhy.	.41
Copper, sulphate	.13
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.20
Nickel carbonate	.32
Nickel sulphate	.20
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lbs	9.00
Sodium phosphate	.15
Tin chloride	.30
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated



GARLOCK-WALKER'S

LIST OF METAL WORKING MACHINERY IN DUFFERIN STREET WAREHOUSE, TORONTO



Lathes—Engine

All sizes of Engine Lathes for 7" x 32 to 36" x 18' with D.B.G. or S.B.G., some with taper attachments.

Lathes, Gap

1—C.M.C. 20" x 36" x 12' Q.C.G., D.B.G., taper attachment.
1—South Bend 21" x 30" x 7' D.B.G., taper attachment.
1—Perfect 12" x 17½" x 6' Gap Engine Lathe.
1—McDougal 22 x 40 x 18 D.B.G. Gap Engine Lathe.
1—Bertram 38 x 54 x 12 Gap Lathe.
1—LeBlond 33 x 60 x 16 D.B.G. and Q.C.G. complete with chucks.

Turret Machines

Milholland, Davis, Oliver make of various sizes and capacities, with full equipment.

Screw Machines

Foster, Prentice, Warner & Swasey and Cleveland, National Acme Automatics.

Drills

3—Woodward & Rogers 4-spindle, ½ in. capacity.
1—Edlund 1B High Speed Sensitive.
1—3-Spindle Silver Gang Drill.
1—20" Rockwell B.G. Power Drill.
1—20" Silver Drill, all geared.
2—20" Champion, all geared Power Drills.
1—36" Bertram B.G. Drill.
1—36" D8 Colburn Drill.
2—No. 1 Burke 10" Sensitive Bench.

Shapers

1—24" McGregor-Gourlay.
1—16" Rae Shaper.
1—14" McKenzie Shaper.
3—14" Davis Crank Shapers.

Grinders

1—12 x 42 Landis Plain Grinder.
1— 8 x 36 Fitchburg Cylindrical.
1—10 x 25 Q.C. Bath Universal.
1—No. 12 Gardner Disc Grinder.
1—Globe Universal Tool and Cutter Grinder
1—Stevens Universal Tool and Cutter Grinder.
1—Lafayette Universal Grinder for lathes.
2—Whitney No. 23 Internal Grinders.
Emery Grinders, Pedestal, bench type.

Millers

2—Briggs Type B42 Traverse (manufact'g).
1—Briggs Type A22 Traverse (manufact'g).
1—No. 1 Bertram Universal with Dividing Heads.
1—No. 2 Ford-Smith Plain Miller.

Compressors

1—12 x 13 Bury with tank and fittings.
1—10 x 18 Belt Driven Ingersoll-Rand.
1—8 x 8 Sullivan Compressor.

Shears, Punches, etc.

1—Ryerson No. 3 Rotary Bevel Shear, 1 in. capacity.
1—4 in. Stroke Double Arch Press Geared.
1—Lennox Rotary Splitting Shear, 24" stroke capacity, ½" plate.
Several small Punches and Shears to ½ in. capacity.

Hack Saws

1—Racine No. 10 Power Hack Saw, 8 x 8 capacity.
1—Peerless Power Hack Saw, 6 x 6 capacity.

Furnaces

1—Bellevue Double Chamber Oil Furnace.
1—12 x 15 x 8 Gas Furnace.
1—18 x 11½ x 8 Gas Furnace (West Magott).
1—24 x 18 x 12 Oil Furnace (Gilbert & Barker), with tank blower and pyrometer.

Miscellaneous

1—Morris Portable Crane, 1½-ton capacity, 10 ft. lift.
1—Canton No. 2 Portable 2-ton Crane.
1—Canton No. 2 Portable 1-ton Crane.
Several Hydraulic and Vacuum Pumps.
Several Blowers, Pressure and Exhaust Fans.
Grant Rotary Riveter, capacity 3-16.
Dividing Head for Miller.
Miller Vise.
Several Chucks.
Valve Milling Machines.
Transmission Supplies.
Several Greenard Arbor Presses.

Woodworking Machinery

We have complete stock of machines for all woodworking operations.

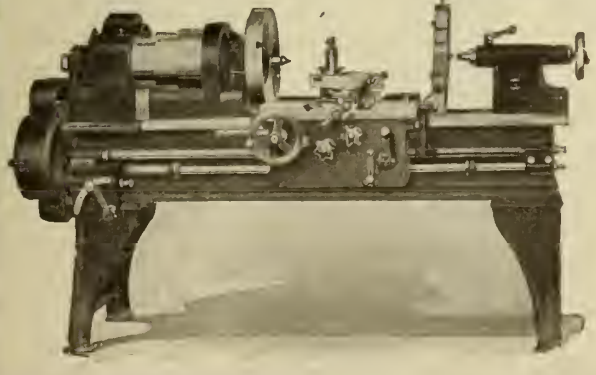
Boring Mills

1—Bement-Niles 66" 2 heads—25' under cross rail.
1—Niles 38" Vertical Boring Mill.
1—Bertram Horizontal 3½" Spindle, 60" between centers.
1—Universal No. 2½ Horizontal Boring Machine.

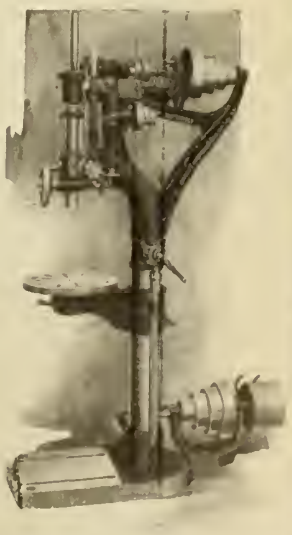
It will be to your advantage to let us have your enquiries

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If interested tear out this page and place with letters to be answered.

WELDERS MEET IN TORONTO AND DECIDE ON ORGANIZATION

"That we form an organization to be known as the Canadian Welding Society." Such was the decision made by a representative group of the welding industry in Canada.

For some time past the need of a society devoted to this branch of industry has been realized. The difficulty lay in the getting together of the different welding experts, but this was overcome on Thursday, December 16th, when about twenty-five met at the offices of the Presto-O-Lite Company, Toronto, to discuss the formation of such a society.

The feature of the meeting was the frank way in which discussion was carried on.

It was clearly pointed out that all classes of welding must be included, if the society was to do the greatest good to the industry. The one-man welder also came in for quite a bit of discussion. By the one-man welder is meant the chap who owns a small portable gas outfit, usually owns a garage or blacksmith shop, and uses his welding outfit very much as a side line.

Should such a man be included? This was the question asked, and most emphatically the answer came back, "Yes." It was clearly proven that it was in such cases that a welding society could prove of real value. Tales were told of such men who had attempted welding jobs far beyond their talents, with the result that the whole welding industry got a black eye, so to speak, as a result of their failure.

After varied discussion on some other points relative to the scope of the society, this motion was adopted: "That the society embrace all processes of welding, including gas, electric, and thermit. That all classes of men and companies connected with or interested in the art of welding be included. That special attention be given to the spreading of publicity regarding the trade, both for the benefit of the general public and the welders themselves.

That the society endeavor to assist in the general advancement of the trade, to work for co-operation amongst companies, employers, and employees, not only in the welding trade, but of all other industries in the metal working field.

It was then decided to appoint a temporary executive committee to carry on the work of drafting an official constitution. J. N. Robinson, A. A. Stewart, and F. Borys were the gentlemen appointed.

Upon this matter being settled, the meeting was adjourned until a later date, some time in January, when permanent officers will be elected. Those present at the organization meeting were as follows:

H. E. Mussett, A. M. McMillan, Canada Carbide Co., Ltd., Montreal; F. C. Hamilton, manager Canadian John Wood Mfg. Co., Ltd., Toronto; J. H. Moore, J. N. Robinson, A. A. Stewart, Toronto; Mr. Damp, manager Damp Bros. Welding Co., Toronto; H. R. Swartley, Jr., vice-president Davis-Bournonville Co., Jersey City; J. F. Crowley, W. H. Ludington, Davis-Bournonville Co.; W. F. Thatcher, manager Dominion Oxygen Co., Ltd., Toronto; F. Borys, J. Moss, Mr. McDougall, Toronto; H. E. Smithies, Lincoln Electric Co. of Canada, Limited, Toronto; J. M. McDonald, welder, St. Catharines; A. J. McDougall, Mr. Skelly, secretary National Electro Products, Ltd., Toronto; R. H. Combs, Mr. Montgomery, Prest-O-Lite Co. of Canada, Ltd., Toronto; A. M. Barry, St. Lawrence Welding Co., Ltd., Montreal; T. C. McAree, Toronto Power Co., Ltd., Toronto; F. J. Padbury, Toronto Welding Co., Toronto; H. N. Griffiths, Union Carbide Co. of Canada, Limited, Welland.

SETTLED PRICE OF STEEL RAILS

Case Came From Cancellation of Contracts During the Time of the War

OTTAWA.—Judgment in the claim of the Dominion Iron & Steel Corporation against the Dominion Government for rolling 100-000 tons of steel rails ordered by the Government during the war was delivered by Sir Walter Cassels in the Exchequer Court. The President, in his judgment, fixed the price to be paid at the rate of $65 a ton for No. 1 rails and $63 a ton for No. 2 rails. The claim of the company for interest on profits lost through the fulfillment of this Government order was disallowed.

Each side was ordered to pay its own costs.

The prices arrived at were those which had been estimated by the Minister of Railways, and the judgment upholds the opinion of the Minister. The claim of the company was for the price of the rails plus compensation for profits lost through the necessary cancellation of contracts with the Imperial Munitions Board.

The company's claim for interest on profits lost was disallowed. The suit involved the sum of $1,116,000.

The Men Escaped.—The new Canadian Government steamer, Canadian Explorer, prematurely launched herself at the Halifax Shipyards a few days ago twenty minutes ahead of time. Eight workmen who were engaged in removing supporting blocks crouched down beneath the ways as the great ship began to move, and were discovered to be uninjured after the ship had passed safely over them and plunged into the harbor. No one was injured.

Trade Gossip

Wants Small Lathe.—Daniel J. McLaughlin, Box 620, Pembroke, Ont., wants to secure a bench lathe for experimental work. He intimates that a used machine will suit his purpose.

Build New Station. — L'Air Liquide Society has erected a new station for oxygen and acetylene distribution at Sudbury,. This makes the eighth distributing plant to be put in operation.

New Industry for Arnprior.—A plan of industrial development which must mean a great deal to the progress of Arnprior, Ont., is in process of being worked out by McLachlin Bros., Ltd., and the proposal to increase the company's fixed assessment is to be voted on by the ratepayers at next municipal election. The project is to build a solid concrete dam across the Madawaska River, 150 feet north of the present mill bridge, and develop at once 2,000 horsepower electric energy, carrying it to the point at the mouth of the river, where a pulp-grinding mill will be built of an initial capacity of 30 tons a day. The company's present fixed assessment is $125,000, and a by-law is prepared providing for a fixed assessment of $150,000 for the next ten years.

Service to India.—The steamer Trevean, 3,217 tons net, the second British steamer supplied under the agreement between the British India Steam Navigation Co. and the Canadian Government Merchant Marine for a joint service from Halifax or St. John in the winter and Montreal in the summer to India and the Far East, will arrive at St. John early in January from Avonmouth, and after loading a general cargo will leave that port again on January 15. A C.G.M.M. official said that business prospects on this service were very satisfactory, considering the general freight depression.

Had Successful Year. — The annual general meeting of the shareholders of the William Hamilton Company, was held at the Peterboro office of the company. The report of the directors for the financial year ending September 30, 1920, was presented by the directors and was accepted. The statement showed the affairs of the company to be in a very satisfactory condition and the prospects bright for the coming year. The company has a large number of contracts and orders on hand sufficient to keep the plant running at capacity. The company's business comprises the manufacture of hydraulic equipment, pump and saw mill machinery and general plate and steel construction work.

It is estimated that the new livestock arena at the Exhibition Grounds, Toronto, will cost about $1,500,000, and that it will provide seating capacity for 7,500 people.

Morrow Drills

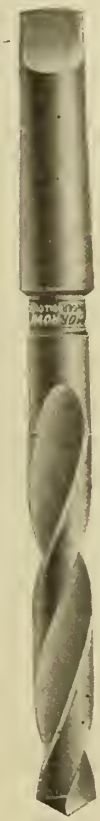
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WHEN ANSWERING ADVERTISEMENTS KINDLY MENTION NAME OF THIS PAPER

PIG IRON TRADE

There is a slight increase in pig iron sales. On the Philadelphia market round tonnage of Eastern basic has been sold for prompt shipment at a price equivalent to $33.50 delivered eastern Pennsylvania. The furnaces report a great increase in the number of cancellation requests, but they still refuse requests excepting where they themselves are at fault in not living up to their contracts.

Though recent declines in furnace quotations have not brought about added buying on the Chicago market, there is an undercurrent of interest in the situation. This is shown by more inquiry which is believed to be for the purpose of establishing prices for inventory. It is expected that some of the inquiry now being made will result in sales.

The market at Pittsburgh during the week has shown no inquiry, or spot purchases. Prices on Bessemer and malleables are unchanged from last week at $39 valley and basic at $33 valley. Owing to the fact that it is claimed that the supplies in the hands of melters are low, predictions are being made that when a buying market sets in it will involve good sized tonnages of steel making and foundry grades.

Though the Boston market shows little improvement outwardly, a different tone is apparent. Consumers are beginning to ask whether it is advisable to buy or not. The general feeling is that the slump has passed.

A sale was made during the week on the New York market of 8,000 tons of foundry iron to the United States Cast Iron Pipe and Foundry Co., for the first quarter delivery, at $38 base Birmingham, by the Tennessee Coal, Iron and Railroad Co.

A slight increase in inquiry is noted on the Buffalo market. One interest reports inquiries amounting to 4,000 tons for foundry and 1,000 tons of malleable. About 600 tons of foundry iron have been sold at about $35 for No. 2 plain 1.75 to 2.25 silicon.

A better volume of business has been closed in the Cleveland district during the past week and as a result there has been a slight improvement in sentiment. The iron sold is for prompt, or December-January delivery, which shows that some consumers are being forced to cover immediate needs.

Scrap Metal Market

Declines are reported in nearly all the markets. Heavy lists are still offered by railroads but no buying is being done.

General buying is absent in scrap iron on the Chicago market and the few inquiries entertained by dealers are for carloads to fill at the end of the year. Railroad offerings are large and prices offered are not attractive. As a result the roads are retaining most of their scrap. This is not troubling the dealers as they would prefer this to having it hang over the market unsold.

Boston market shows a still further softening in nearly all the grades of scrap iron and steel during the week. Heavy melting steel dropped to a new low of $11 delivered to dealers' yards and all other grades are quoted at $1.00 lower than last week.

Only four grades have dropped in price on the New York market during the past week. These include heavy melting steel, now holding at $11.50 to $12 f.o.b. New York, and mixed borings and turnings quoted at $9.50 to $10. There has also been a decline of $2.00 in clean cast borings. On the whole the situation remains very weak.

A slight improvement is noted on the Buffalo market, to the extent that some mills think it a good time to make purchases on account of the low prices. They are not able to get the material in the tonnages they would like. All prices quoted are nominal.

On the Philadelphia market the prices in scrap continue to decline. Cupola cast is now selling at $26 to $27 and some even has been sold at $25.

Prices have fallen sharply on the Pittsburgh market during the past week. The greatest decline shown is in iron and steel car wheels.

May Cut Plate Price. — Negotiations are in progress for a reduction in the contract price with the Dominion Steel Company for steel plates supplied the Government from the Sydney plant. The contract calls for fifty thousand tons a year. The present price is around $3.65 per hundred pounds, and this is a reduction from the original. A further cut is now proposed in view of the much lower rate prevailing in the market. Negotiations to this end are about concluded between the Government and Mr. Roy Wolvin, head of the Dominion Company.

Will Sell Yards.—After the two ships are completed for the Government at the Dominion shipbuilding yards, Toronto, it is probable that the plant will be put on the market and sold for a machine shop, street car property or put to some other similar use, according to Mr. Osler Wade, liquidator for the company. The plant, which is a modern one, has been placed in the hands of Joseph Day, 67 Liberty Street, New York City, agent for industrial sites, but nothing can be done until the two boats are gotten out of the way. Mr. Wade stated that the Collingwood Shipbuilding Co. has undertaken to finish this work but has not taken over the yards permanently. It will take approximately five months to finish the ships, and about 1,000 men will be employed very soon. At present this number will not be taken on.

Will Develop Plant.—It has been reported that the United States Steel Corp. has voted $291,420 for the extension of the Essex Terminal Railway for running several spurs from the main line of the route into the plant of its subsidiary, the Canadian Steel Corporation at Objibway.

Power for London.—The Ontario Power Commission has approved of plans for a Hydro Sub-station in East London to cost $35,000, to accommodate the new industrial area that the city has established there. Work will begin at the first of the new year and filtration equipment will also be installed at the Horton street pumping station at a cost of $55,000.

Ready to Operate.—The new industrial plant of Machinery and Foundries, Ltd., Brockville, Ont., is almost ready for operation. General foundry and machine products will be turned out and special attention will be paid to the manufacture of power and hand pumps. The cost of the construction of the plant will be about $75,000.

Fuel for West.—It is reported by the Bureau of Research, Ottawa, that lignite briquets are being turned out at Estevan, Sask., which are equal to anthracite coal and will be sold at half the price or less. The plant is maintained by the Dominion, Saskatchewan and Manitoba governments and can turn out 50,000 tons per year.



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CLOSING TIME

Advertisements for this section must be in our composing room at noon on Tuesday prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed please try to have them in our office with the Tuesday morning mail.

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No. 1 Dow, Plain, new Miller
No. 3 Burk Hand Miller
No. 3½ Fox Hand Miller
6' Western Universal Radial Drill
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What Will Santa Claus Bring Our Politicians ?

"SANTA'S POLITICAL STOCKING" is the title of J. K. Munro's feature article in MACLEAN'S December 15th issue. Mr. Munro thinks old Kris Kringle should bring Premier Meighen a "cap that will pull down over his ears, so that he can't hear what his Cabinet colleagues are saying about him"; a hobby horse for Crerar; a tin sword for Ballantyne; a "white plume" for Lapointe; a case of grape juice for Rowell, and a pair of long trousers for Mackenzie King.

Mr. Munro also sizes up the East Elgin farmers' victory, and lets you know its real significance.

Dr. Wilfred T. Grenfell, C.M.G.

THE famous physician of Labrador has contributed a striking piece of graphic fact-fiction for the Christmas issue—"Deeds of 'Derring Do'," which describes the brave fight waged by Skipper Loveday, his crew and wife—in the dismantled Silver Queen. They expected to find a watery grave that Christmas week, but the wife's dauntless spirit put so much courage into the men that they won a fearful fight against the December gales.

Christmas Issue of Maclean's, December 15th

"THE EMANCIPATION OF POLLY MacCRAE"
By F. B. M. Collier.

The so-human story of two spinster sisters in Old Ontario and how the crippled one won a husband.

"THE JEST OF CIRCUMSTANCE"
By Gertrude Arnold.

Phyllis lands in a Canadian city, fresh from England, and there is no fiancé to meet her. The girl ultimately finds happiness just as the Christmas Carols commence—but how?

"OUR GOLDEN FLOOD ROARS EAST"
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Every few minutes a train loads up at one of our many mammoth grain elevators, taking our wheat to the seaboard.

"THE CITY OF PERIL"
By Arthur Stringer.

The largest instalment yet published of this sensational dramatic serial of Bolshevistic plotting in New York.

"—AND ALL POINTS NORTH."
By Nellie L. McClung.

A gripping story of the pioneer men and women of the Peace River country—many even out of the reach of railroads, telephones and doctors. Read what trained nurses are doing in the pioneer settlements.

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Morse Chain Co., Ithaca, New York.
Renold of Canada, Ltd., Montreal.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Renold of Canada, Ltd., Montreal.
Williams Mchy. Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Can. Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N. Y.
Glasgow, N.S.
Renold of Canada, Ltd., Montreal.

CHAINS, SPROCKET WHEEL
Can. Link Belt Co., Ltd., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Ltd., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold of Canada, Ltd., Montreal.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Labatory, Ltd., Toronto.

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.
Union Manufac'g Co., New Britain, Conn.

CHUCKS, COLLET, AIR
Petrie, Ltd., H. W., Toronto.
Williams Mchy. Co., A. R., Toronto.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto. Ont.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford
Foss Mchy. & Sply Co., Montreal.
Gardner, Roht. & Son, Montreal.
Garlock-Walker Machinery Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Herbert, Ltd., Alfred, Toronto, Ont.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Union Manufac'g Co., New Britain, Conn.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Strelinger, Chas. A. Co., Windsor, Ont.
Union Manufac'g Co., New Britain, Conn.

CHUCKS, FRICTION AND TAP
Union Manufac'g Co., New Britain, Conn.
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Union Manufac'g Co., New Britain, Conn.
Williams Mchy Co., Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Warner & Swasey Co., Cleveland, O.
Williams Mchy. Co., A. R., Toronto, Ont.

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAY FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Can. Hanson & Van Winkle Co., Ltd., Torono, Ont.

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.

CLOCK SPRINGS
The Dunbar Brother Co., Bristol, [illegible]
Oakley Chemical Co., New York, N.Y.

CLOSETS
Crane, Ltd., Montreal, Que

CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

COAL CRUSHERS
Can. Link-Belt Co., Ltd., Toronto, Ont.

COAL HANDLING MACHINERY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Nova Scotia Steel & Coal Co., New

COLD ROLLED STRIP, ALL METAL COLLARS, SHAFTING
Can. Driver-Harris Co., Ltd., Walkerville.
Williams & Co., J. H., Brooklyn, N.Y.

COLLECTORS, PNEUMATIC
Can. Blower & Forge Co., Kitchener
Sturtevant Co., B. F., Galt, Ont.

COMPOSITION INGOT
Canada Metal Co., Toronto.

COMPOUNDS, CUTTING AND GRINDING, DRAWING STAMPING
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR
Atkins & Co., E. C., Hamilton, Ont.
Can. Ingersoll-Rand Co., Sherbrooke.
Cleveland Pneumatic Tool Co., Toronto.
Curtis Pneumatic Machy. Co., St. Louis
Garlock-Walker Machinery Co., Toronto.
Holden Co., Ltd., Montreal, Que.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Superior Machinery Co., London, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CONDENSERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
MacGovern & Co., Montreal, Que.

CONDUITS
Northern Electric Co., Ltd., Montreal, Que.

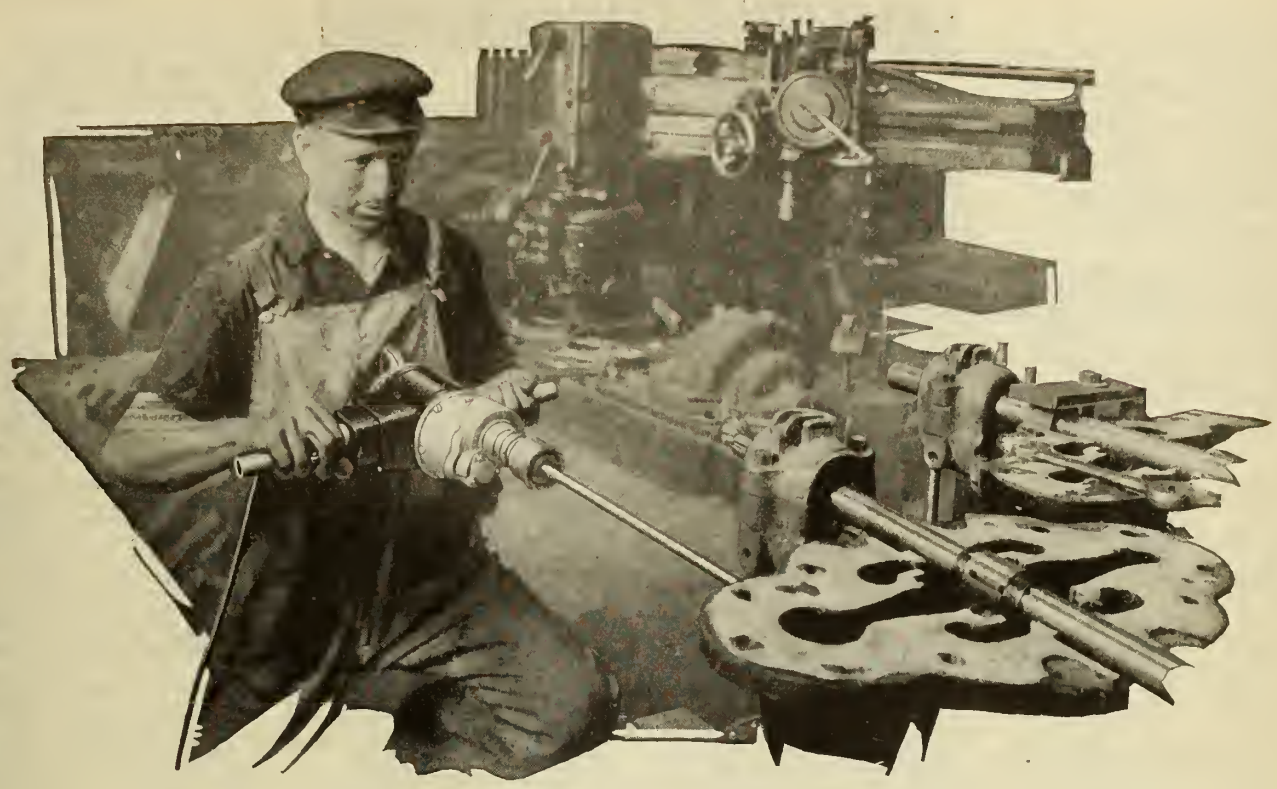
CONNECTING RODS
Canada Found's & Forgings, Ltd., Welland. Ont.

CONNECTING ROD CUTTERS INTERCHANGEABLE
Eclipse Counter bore Co., Ltd., Walkerville, Ont.

CONTRACT WORK
Brown Engineering Corp., Toronto.
Ford-Smith Machine Co., Hamilton, Ont
Globe, Engineering Co., Hamilton, Ont.
Katie Foundry, Ltd., Galt, Ont.
Victoria Foundry Co., Ottawa.

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GIANT OIL AND GAS ENGINES ROCK DRILLS · COAL DRILLS

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Electric Tools

CONTROLLING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

CONVERTERS, ROTARY
MacGovern & Co., Montreal, Que.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.

COOLERS, WITH DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

COPING MACHINES
Bertram & Sons Co., John, Dundas, Ont.
Dom. Steel Products Co., Ltd., Brantford
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Can. Blower & Forge Co., Kitchener.

COPPER, BUS BAR, SHEET, PLATES, RODS
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper and Brass Rolling Mills, New Toronto.

CORE OIL
Swan & Finch, Inc., 165 Broadway.

COUNTERBORES AND COUNTERSINKS
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Eclipse Counterbore Co., Ltd., Walkerville.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Strelinger, Chas. A. Co., Windsor, Ont.

COUNTERSINKS, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

COUNTERBORES, INVERTED, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

COUNTERSHAFTS
Almond Mfg. Co., Ashburnham, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Baird Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., Ltd., A. R., Montreal
Williams Mchy Co., A. R., Toronto.

COUPLINGS, FRICTION
Bernard Industrial Co., The A., Fortierville, Que.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto.

COUPLINGS, RAPID HOSE
Ont. Machinery & Supply Co., Ltd., Montreal, Que.

COILING MACHINERY, WIRE AND SPRING
Garlock-Walker Machinery Co., Toronto.

BUCKET
Hanna & Co., M. A., Cleveland, O.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Cleveland Pneumatic Tool Co. of Canada, Toronto.

CRANES, OVERHEAD, HAND AND
Gardner, Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Northern Crane Works, Walkerville.

ELECTRIC
Volta Manufacturing Co., Welland, Ont.

CUPS, OIL
Can. Winkley Co., Ltd., Windsor, Ont.

COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.

CRANES, GRAVITY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

CRANE RUNWAYS
MacKinnon Steel Co., Sherbrooke, Que.

CRANES, JIB
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, LOCOMOTIVE
Brown Hoisting Machinery Co., Cleveland, Ohio.
Holden Co., Ltd., Montreal, Que.

CRANES, GOLLIATH, PNEUMATIC AND PORTABLE
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane and Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Petrie, Ltd., H. W., Toronto.

CRANES, PILLAR
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy. Co., A. R. Toronto, Ont.

CRANES, TRAVELLING, ELECTRIC AND HAND POWER
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Oliver Engineering Co., Montreal.

CRANK SHAFTS
Can. Found's & Forgings Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.

CRANK PIN TURNING MACHINE
Herbert, Ltd., Alfred, Toronto, Ont.

CRIMPS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass.

CRUSHERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.

CUPOLAS
Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.

CURB PUMPS FOR OIL, GASOLINE
Bowser Co., Ltd., S. F., Toronto, Ont.

CURRENT TRANSFORMERS
Volta Manufacturing Co., Welland, Ont.

CUT-OFF COUPLINGS, FRICTION
Petrie, Ltd., H. W., Toronto.

CUTTERS, BOLT
See Bolt Cutters.

CUTTERS, GEARS
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto

CUTTER HEADS
Oliver Machinery Co., Grand Rapids, Mich.

CUTTERS, PIPE (See Pipe Cutters)

CUTTERS, HIGH SPEED
Madison Mfg. Co., Madison, Wis.

CUTTERS, MILLING
Butterfield & Co., Rock Island, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Sply. Co., G. E., Montreal.
Garvin Machine Co., New York.
Ingersoll Mache. Co., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg. Co., Hartford, Conn.
Wilt Twist Drill Co., Walkerville, Ont.

CUTTER RELIEVING MACHINES
Cleveland Milling Machine Co., Cleveland

CUTTING-OFF MACHINES
Armstrong Bros., Tool Co., Chicago.
Atkins & Co., E. C., Hamilton, Ont.
Bertram & Sons Co., John, Dundas.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
G. F. Foss Mchy. & Sply. Co., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass.
Kennedy & Sons, Wm., Owen Sound
Lyman Tube & Supply Co., Montreal, Que.
Niles-Bement-Pond Co., New York.
Prest-O-Lite Co., Inc., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Williams Tool Corp. of Canada, Ltd., Brantford, Ont.
Wells Bros., of Can., Galt, Ont.
Williams Mchy. Co., A. R., Toronto, Ont.

CUTTING COMPOUND AND CUTTING OIL
Cataract Refining Co., Ltd., Toronto.
Swan & Finch, Inc., New York.

CUTTING OIL, RECLAIMING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

CUTTING AND WELDING PLANTS
Davis-Bournonville Co., Jersey City, N.J.
Prest-O-Lite Co., Inc., Toronto, Ont.

CYANIDE AND LEAD BATH POTS
Swedish Crucible Steel Co., Windsor.

CYLINDERS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton, Ont.

REHUMIDIFYING
B. F. Sturtevant Co., Galt, Ont.

DERRICKS
Aikenhead Hardware Co., Toronto, Ont.
Dominion Bridge Co., Montreal.
Hepburn Co., Ltd., J. T., Toronto, Ont.
Morris Crane & Hoist Co., Sherbrook.

DIAMOND (BORTZ)
Furniss, Clarke & Co., Montreal, Que.

DIAMOND TOOLS
Can. Desmond-Stephan Mfg. Co., Hamilton.
Ford-Smith Machine Co., Hamilton, Ont.
Furniss Clark & Co., Montreal, Que.
Joyce-Koebel Co., Inc., New York City
Wheel Trueing Tool Co., Detroit.
Petrie Ltd., H. W., Toronto.

DIAMONDS, CARBON AND BORTZ
Joyce Koebel Co., Inc., New York, N.Y.
Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.

DIE CASTINGS
Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

DIE HEADS, AUTOMATIC
Greenfield Tap & Die Corp., Greenfield Mass.
National Acme Co., Cleveland, Ohio.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

DIES FOR BIT BRACE USE
Butterfield & Co., Rock Island, Que.
Crescent Mche. Co., Ltd., Montreal, P.Q.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Wells Brothers Co., of Canada, Galt.

DIES AND DIE STOCKS
Ackworthie Ltd., J., Birmingham, Eng.
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Brown, Boggs Co., Hamilton, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardiner, Robt. & Son, Montreal.
Herbert Ltd., Alfred, Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Jones & Lamson, Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Strelinger, Chas. A. Co., Windsor, Ont.
Wells Brothers of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DIES, HAMMERED
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, DROP FORGE.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

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Ackworthie Ltd., J., Birmingham, Eng.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall, Galt, Ont.

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Ackworthie Ltd., J., Birmingham, Eng.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Landis Machine Co., Waynesboro, Pa.

DIES, THREADING
Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Crescent Machine Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Acme Co., Cleveland, Ohio
Wells Bros. of Can., Galt, Ont.

DIE SINKERS
Ackworthie Ltd., J., Birmingham, Eng.
Garvin Machine Co., New York.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.
Pratt & Whitney Co., Dundas, Ont.
Walcott Lathe Co., Jackson, Mich

DIES FOR MACHINES
Ackworthie Ltd., J., Birmingham, Eng.
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que.
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt.

DIE HEADS
Greenfield Tap & Die Corp., Greenfield, Mass.
National Acme Co., Cleveland, Ohio.
Wells Bros. of Canada, Galt, Ont.

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Geometric Tool Co., New Haven.
Herbert, Ltd., Alfred, Toronto, Ont.
Landis Machine Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit.
National Acme Co., Cleveland, Ohio.
Wells Brothers Co. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Strelinger, Chas. A. Co., Windsor, Ont.

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Oliver Mach. Co., Grand Rapids, Mich.

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Armstrong-Whitworth of Can., Montreal
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
Firth & Sons, Thos., Montreal, Que.

DIES FOR SCREW PLATES
Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Wells Bros Co. of Can., Galt, Ont.

DIES, SHEET METAL WORKING
Ackworthie Ltd., J., Birmingham, Eng.
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Brown, Boggs & Co., Hamilton, Canada
Globe Engineering Co., Hamilton, Ont.
Stoll Co., D. H., Buffalo, N.Y.

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Ackworthie Ltd., J., Birmingham, Eng.
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros., Co., of Can., Galt, Ont

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Graton & Knight Mfg. Co., Worcester, Mass.

DIRECT CONNECTED UNITS
MacGovern & Co., Montreal, Que.

DRAFT, MECHANICAL
Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sturtevant Co., B. F., Galt, Ont.

DRAINAGE FITTINGS
Crane, Ltd., Montreal, Que.

DRAWING INSTRUMENTS
Hughes, Owens Co., Ltd., Montreal, Que.

DRAWING OFFICE SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

DRESSERS, GRINDING AND EMERY WHEEL
Atkins & Co., E. C., Hamilton, Ont.
Can. Desmond-Stephan Mfg. Co., Hamilton
Dominion Abrasive Co., Ltd., Mimico, Ont
Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont.

DRILL PRESSES
Can. Blower & Forge Co., Kitchener.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
U. S. Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto.

DRILL RODS
Atkins & Co., Ltd., Wm., Sheffield, Eng
Lincoln Electric Co of Canada, Ltd. Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Swedish Steel & Importing Co., Ltd. Montreal.

DRILLING MACHINES, GANG
Bilton Mach. Tool Co., Bridgeport, Conn
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Silver Mfg. Co., Salem, Ohio.
Strelinger, Chas. A. Co., Windsor, Ont.

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John Bertram & Sons Co., Dundas.
Bilton Mach. Tool Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Mach. Co., Toronto.
Garvin Machine Co., New York.
Hoefer Mfg. Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Nat. Automatic Tool Co., Richmond, Ind
Niles-Bement-Pond Co., New York.
Rockford Drilling Mach Co., Rockford, Ill
Strelinger, Chas. A. Co., Windsor, Ont.

DRILLING MACHINES, RADIAL AND TURRET
John Bertram & Sons Co., Dundas.
Canadian Fairbanks-Morse Co., Montreal
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Herbert, Ltd., Alfred, Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Strelinger, Chas. A. Co., Windsor, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLING MACHINES, SENSITIVE
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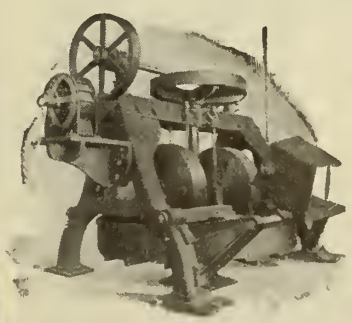
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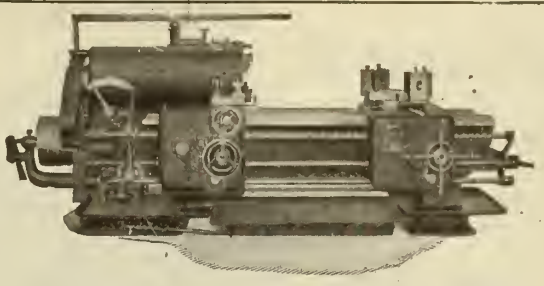


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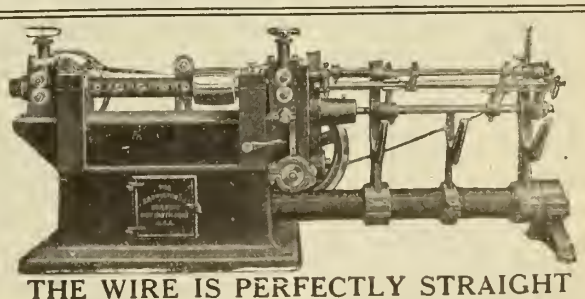
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Independent Pneumatic Tool Co., Chicago.
Int. Mach. & Supply Co., Ltd., Montreal.
Strelinger, Chas. A. Co., Windsor, Ont.

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MacKinnon Steel Co., Sherbrooke, Que.

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Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.

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Petrie, Ltd., H. W., Toronto.
Wells Bros. of Canada, Galt, Ont.

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Elec. Steel & Metals, Welland, Ont.

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Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

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Canadian Link-Belt Co., Ltd., Toronto.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
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Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.
Strelinger Co., C. A., Windsor, Ont.
Lourie Manufacturing Co., Springfield, Ill.

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Dom. Steel Products Co., Ltd., Brantford.
Eastern Production Co., Detroit, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.
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Stoll Co., D. H., Buffalo, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal

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Bliss Co., E. W., Brooklyn N.Y.
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Perrin, Ltd., William R., Toronto.

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Eastern Production Co., Detroit, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Toledo Machine & Tool Co., Toledo.

PRESSES, DROP AND FORGING

Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co. Ltd., Hamilton.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co, Toledo.

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Bertram & Sons Co., John, Dundas.
Can. Ingersoll-Rand Co., Ltd. Sherbrooke.
Dom. Steel Products Co., Ltd., Brantford.
Eastern Production Co., Detroit, Mich.
Lourie Manufacturing Co., Springfield, Ill.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Williams Machy. Co., A. R., Toronto.

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Eastern Production Co., Detroit, Mich.

PRESSES, HYDRAULIC, VERTICAL

Eastern Production Co., Detroit, Mich.

PRESSES, HYDRO-PNEUMATIC

Eastern Production Co., Detroit, Mich.

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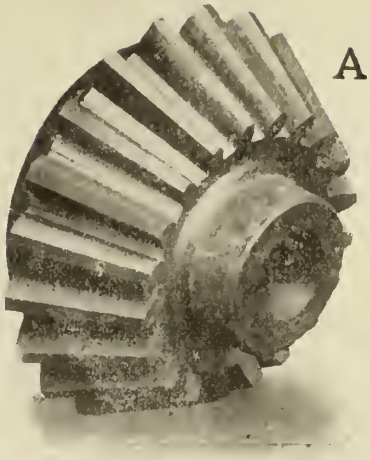
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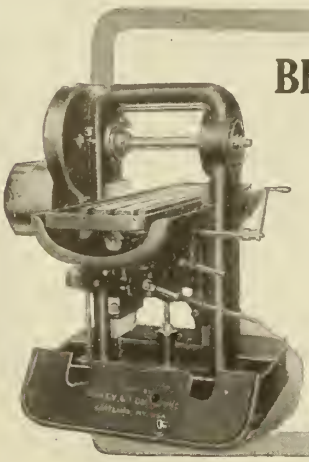
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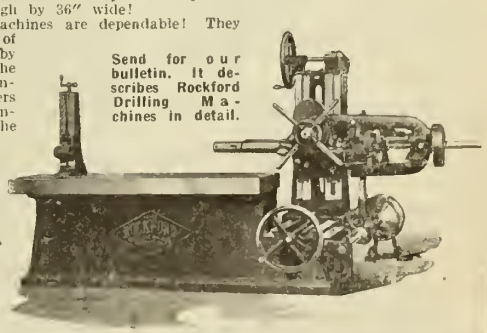
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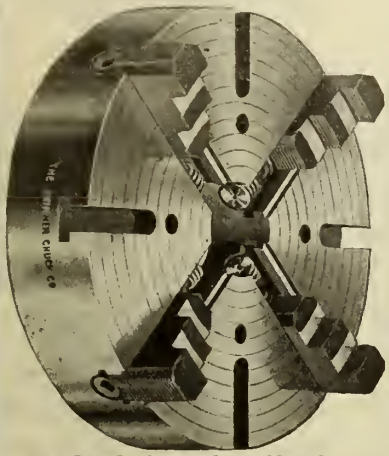
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Greenfield Tap & Die Corp., Greenfield.
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Petrie, Ltd., H. W., Toronto.
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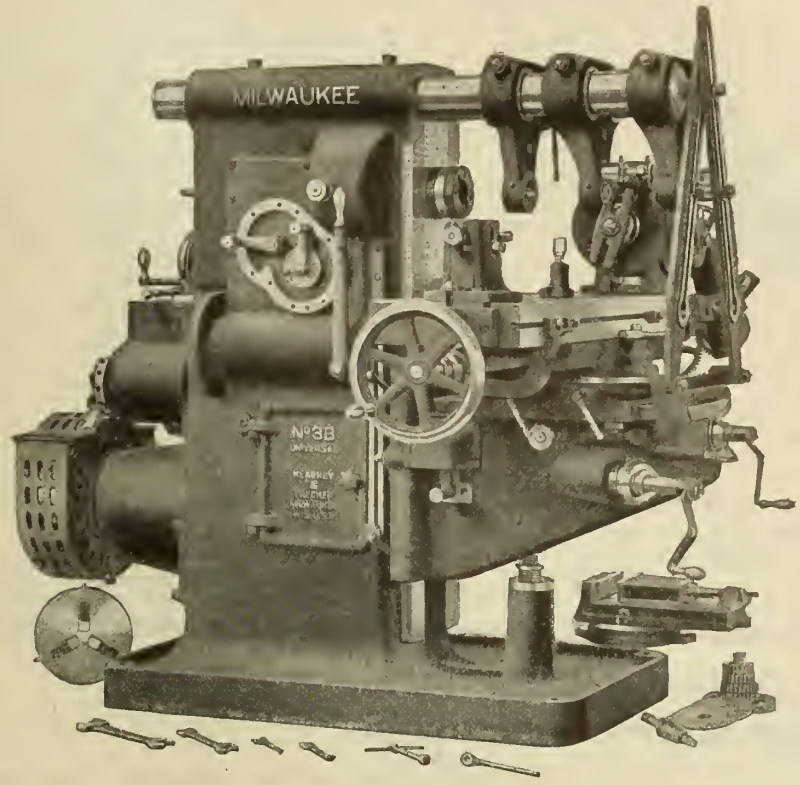
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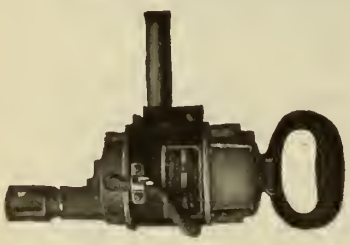
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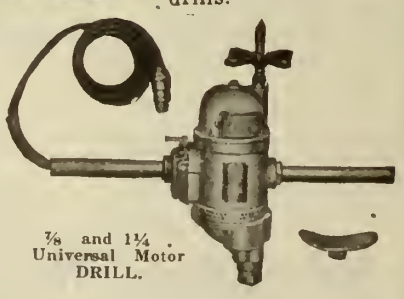
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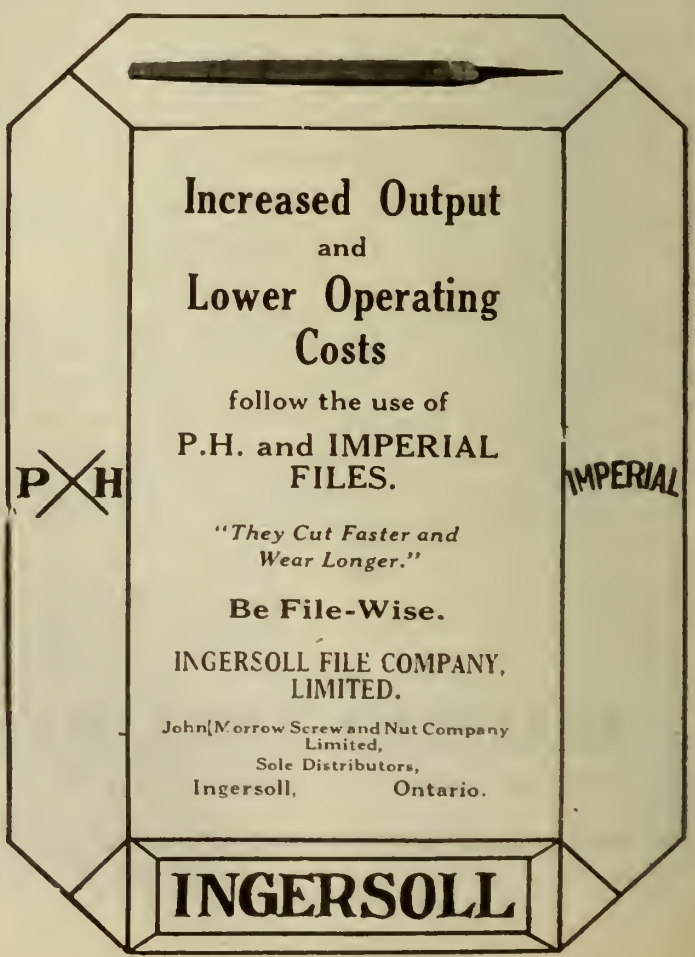
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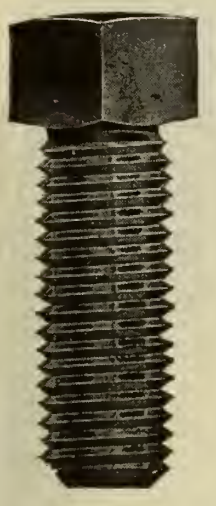
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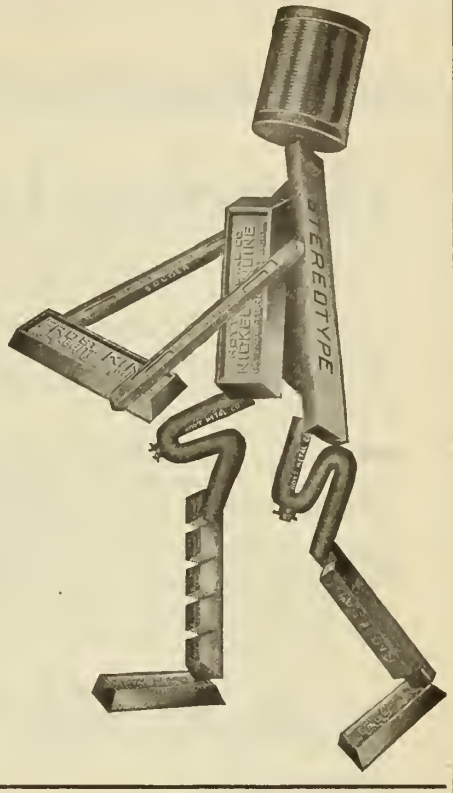
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Hendey Lathes–

"Because they have no superior"

This is candid praise, but five years' experience with four Hendey Lathes enables the National Metal Seal Corporation to know just what Hendeys are capable of.

The praise which Hendey Lathes are winning from hundreds of shops throughout Canada and the United States is ample proof of their merit.

The Hendey shown is turning and boring punches of manganese bronze, removing stock to a depth of 2-in. within limits of accuracy of .0005 in.—and the operator is able to take a fast feed.

Remember what present users of Hendeys think of their performance when in need of lathes, shapers or millers.



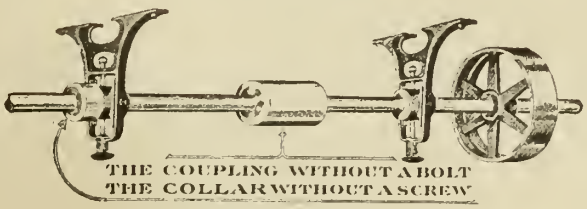
The Hendey Machine Company

Torrington, Conn., U.S.A.

Canadian Agents:

A. R. Williams Machinery Co., Vancouver. A. R. Williams Machinery Co., St. John, N.B.
A. R. Williams Machinery Co., Toronto. A. R. Williams Machinery Co., 260 Princess St., Winnipeg.
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SHAFT COUPLING
TRADE MARK REGISTERED



This Doesn't Look Much Like the Ordinary Shaft-Coupling, Does It?—

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You can install the Bull Dog Shaft Coupling anywhere in five minutes with your bare hands.

Turn on the power and Bull Dog Grips—the greater the load the tighter the grip. Just like driving home a wedge.

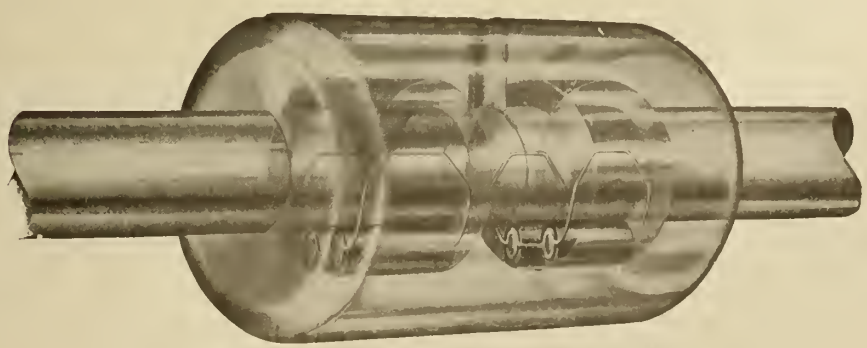
It must be good or they wouldn't have adopted it in thousands of big plants, like Singer Mfg. Co., Bullard Machine Tool Co., New Departure Ball Bearing Co., etc.

Don't take our word for it—try out the Bull Dog Coupling in your plant. We will gladly send you one or more for 30-day trial. If not satisfactory return them at our expense.

Canadian Distributors

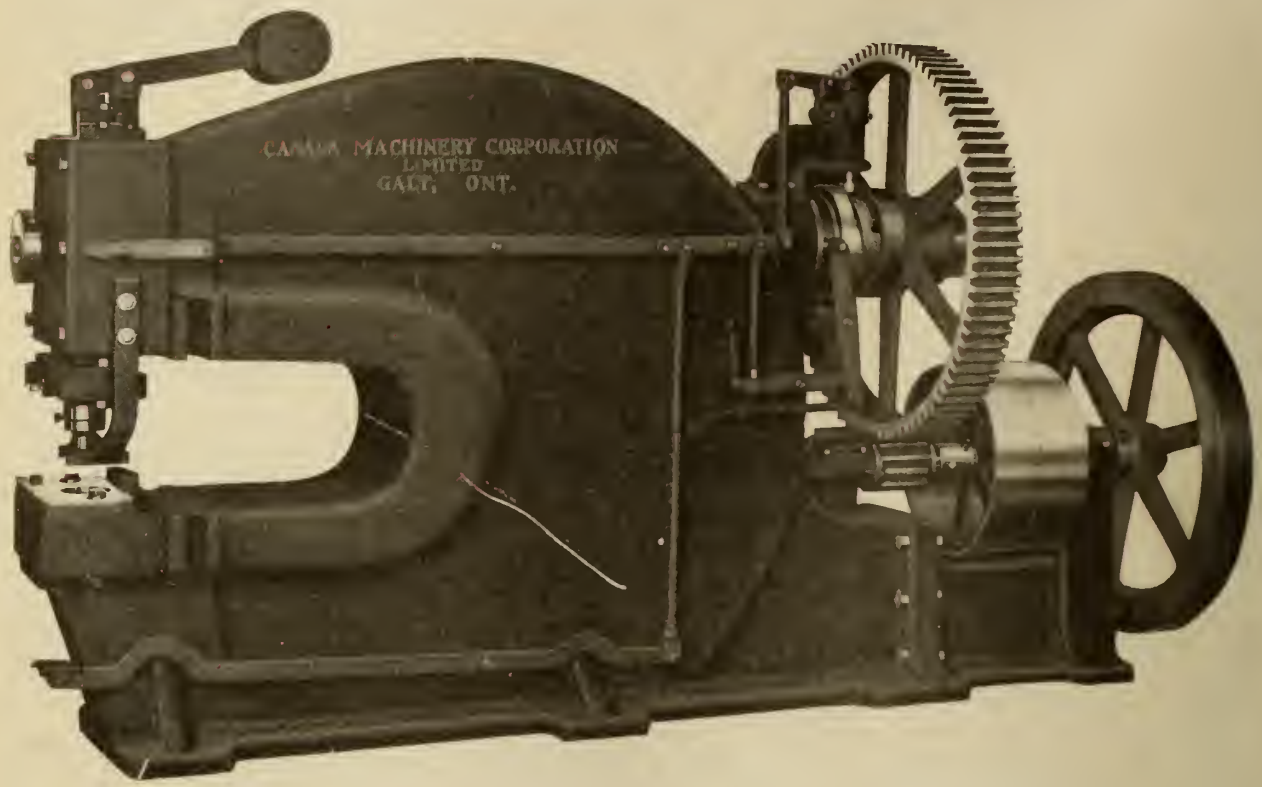
The Geo. F. Foss Machinery & Supply Co., Limited

305 St. James Street, Montreal



C.M.C.

No. 4 Punch or Shear



No. 4 Punch with 36" Throat

A satisfactory Punch is one that has the simplest possible mechanism and ample strength to do the work required of it.

These points have been emphasized in the design of our machines. In addition, we use the highest grade materials and build them carefully.

We can supply Punches and Shears, both single and double end, for motor or belt drive, in various sizes.

Write for descriptive literature

CANADA MACHINERY CORPORATION
LIMITED

GALT - ONTARIO

Vol. XXIV ANNUAL REVIEW NUMBER No. 27

CANADIAN MACHINERY

AND MANUFACTURING NEWS



Toronto
Dec. 30 1920

THE JOHN BERTRAM & SONS Co., Limited, Dundas, Ontario
PIONEERS IN THE MANUFACTURE OF MACHINE TOOLS IN CANADA
AND STILL IN THE LEAD

HALIFAX MONTREAL TORONTO WINDSOR WINNIPEG VANCOUVER

The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, Vancouver, London, New York, Boston, Chicago, Cleveland



SMALL TOOLS

OF PROVEN QUALITY

Stamina, speed, assured satisfaction—by these our Small Tools are judged. We rest upon the verdict of the men who use them.

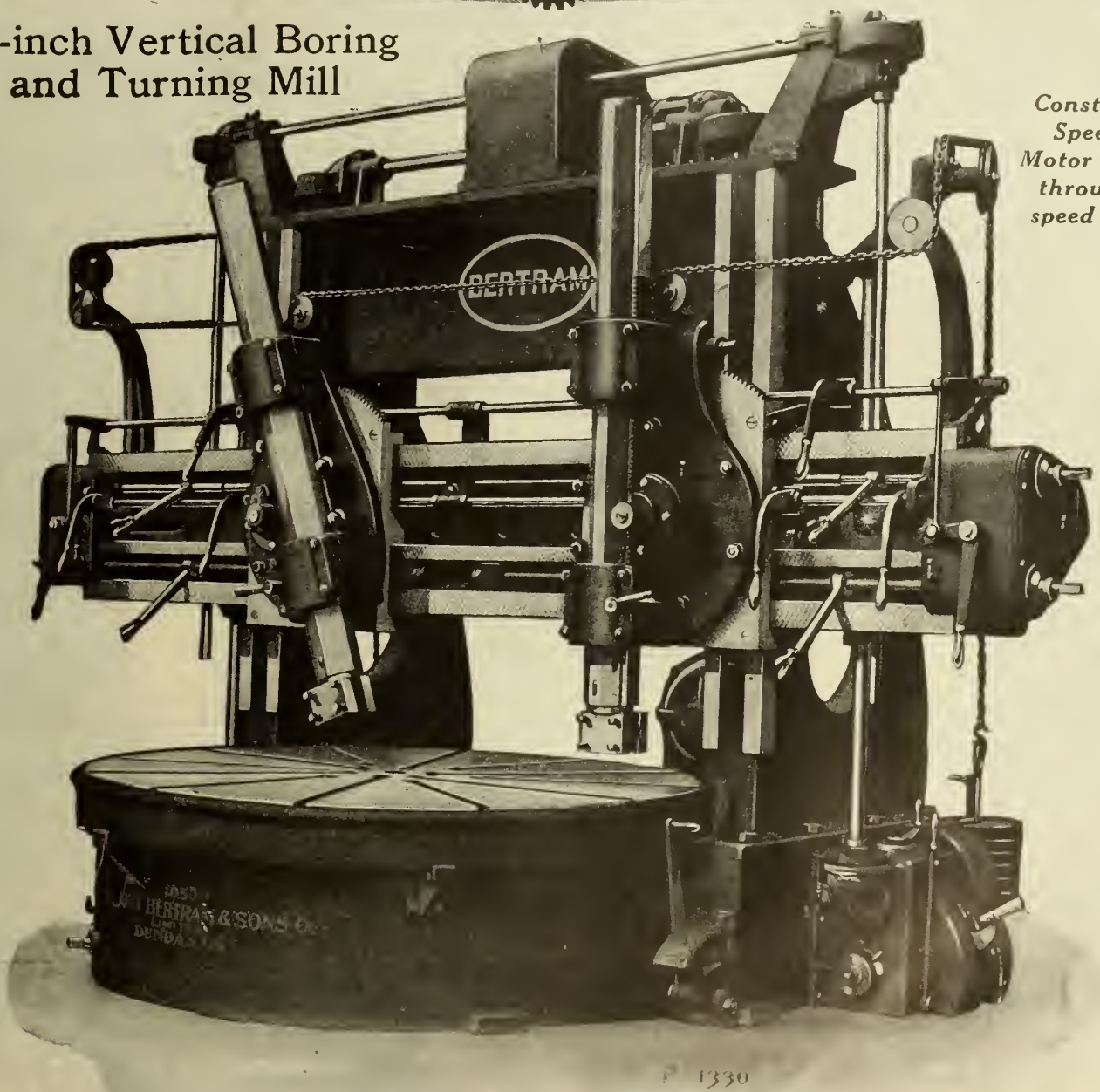
PRATT & WHITNEY CO. OF CANADA, LTD.
DUNDAS, ONT.

The BERTRAM Page

MACHINE TOOLS

84-inch Vertical Boring and Turning Mill

Constant Speed Motor drive through speed box



The John Bertram & Sons Co., Limited

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THE STANDARD OF QUALITY

SPEEDICUT HIGH SPEED and **EXTRA CAST STEEL** are our Leading Qualities. These remarkable Steels have solved the tool problems for others—Why not have your problems solved?

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BEST CAST Chisel Steel BEST CAST Sheet Steel

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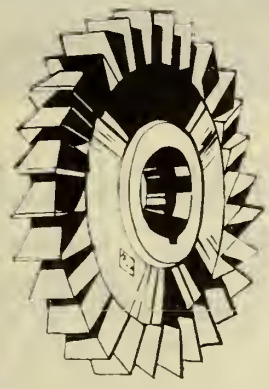
JOHN J. COLEMAN, Canadian Manager.

If interested tear out this page and place with letters to be answered.

WILT

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High Speed and Carbon Twist Drills, Reamers and Milling Cutters



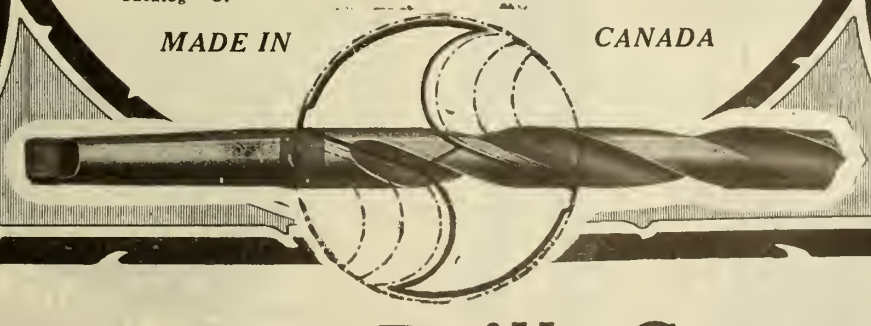
Ask your dealer or write direct for Catalog "C."

The Standard of Quality

How many times have you heard that some other tools "are as good as Wilt"? There must be, and is, a reason for this expression. Do you ever think of it? The merchant selling the other tools recognizes the quality of Wilt and therefore compares those which he sells with tools whose merit is well-known.

The next time anyone says a tool is "as good as Wilt," consider why he makes the statement.

MADE IN CANADA

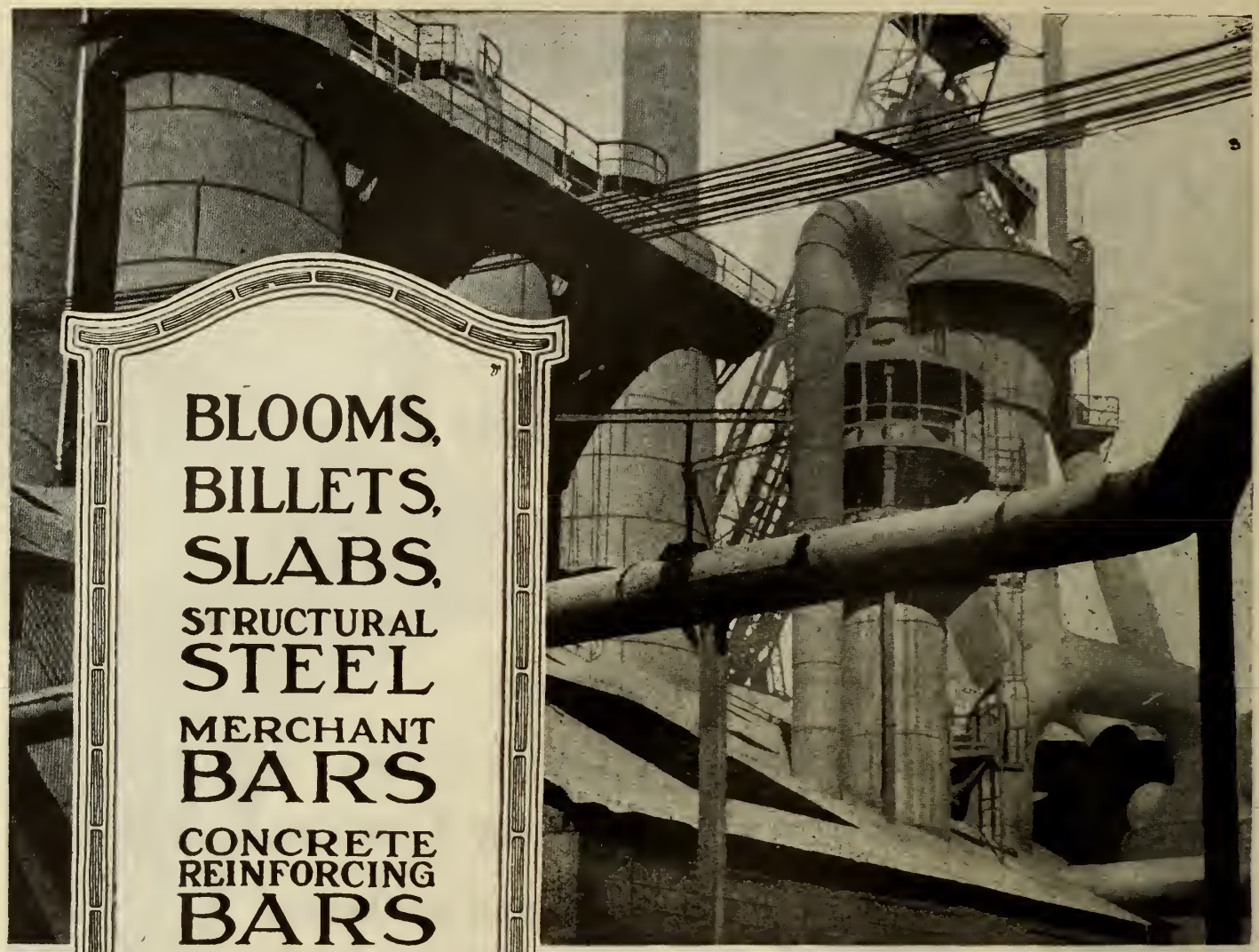


Wilt Twist Drill Company of Canada, Limited

Walkerville Ontario

TRADE WILT MARK

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MALLEABLE
SULPHATE OF
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THE JOHNSON FRICTION CLUTCH

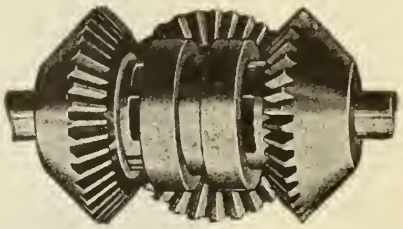


Johnson Clutch Installation on a Newton Milling Machine

Clutches for Reversing Functions

A reversing clutch is a very common requirement on machinery, and one which is encountered in many different forms. Whatever the situation may be, a Johnson Clutch offers the best method of handling it.

The bevel gear assembly shown here is one of the ways in which a Johnson Double Clutch is frequently applied for reversing functions. Many of the best machine tools are equipped in this manner.



Double Clutch in Nest of Bevel Gears

Write for our Yellow Catalog, and Booklet,

"Clutches As Applied To Machine Building."

CANADIAN AGENTS:

WILLIAMS & WILSON, LIMITED, 84 Inspector Street, Montreal

CANADIAN FAIRBANKS-MORSE CO., LIMITED, Montreal, Toronto and Winnipeg

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN

Announcing



the issuance of a new catalog of prime interest to all users of milling and gear cutters and small tools. Herein you will find listed styles and sizes of end mills (special and plain) T-slot cutters. Key cutters, thread mills, gear slots—in fact your needs in the small tool line of this class are sure to be covered. Get your copy and note its completeness.

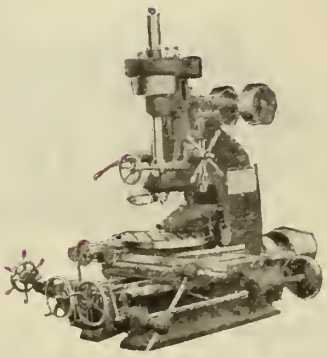
If your special requirement doesn't appear, Bilton can produce it—and in true Bilton Quality.

Just sign your name and address on a card and post it to

The Bilton Machine Tool Company
Housatonic Ave., Bridgeport, Conn.

ALFRED

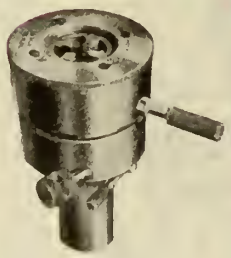
1-3 JARVIS STREET



Horizontal and Vertical Milling Machines, manufactured in a range of sizes.



MACHINE TOOLS



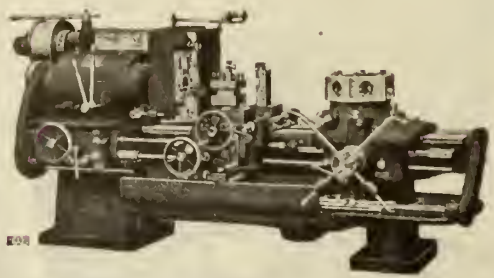
The Coventry Self-Opening Die Head, made in seven sizes—5-16" to 3".

THE machine tools included in the equipment of a modern engineering works may be roughly divided into two classes—main and auxiliary. Whilst the character of the former will vary with the nature of the work, the latter are, generally speaking, the same throughout the entire industry.

Thus the main plant of an automobile factory will consist largely of full and semi-automatic turret lathes, milling machines, gear cutting machines and grinding machines, which are used only to a comparatively small extent in a marine engine shop.

The auxiliary plant, however, will be much the same in both establishments; cutting-off machines, tool, cutter and twist drill grinding machines, universal milling machines, tool-room lathes and universal grinders being necessary in some degree to all metal working undertakings.

For the last 25 years both main and auxiliary plant have been supplied by this firm for every kind of engineering work produced by machine tools.



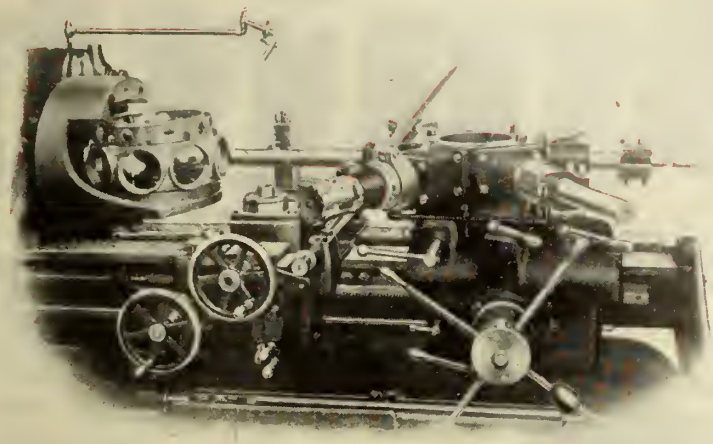
Combination Turret Lathes, made in five sizes—13" to 28" swing.

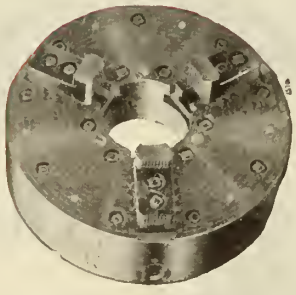
HEAD WORKS:

COVENTRY, ENGLAND

HERBERT

TORONTO, ONTARIO *LIMITED*





The Coventry Concentric Chuck, made in six sizes, 9" to 25".

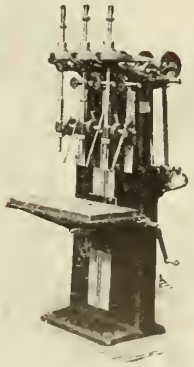
OF QUALITY

THE manufacturing energies have been principally devoted to the development of a line of labour-saving machine tools used for repetition work. Turret lathes, capstan lathes, auto lathes and full automatic screw machines have always been a specialty. These machines are offered fully equipped with all the special tools and fixtures necessary for producing any specified work and at the same time guarantees of production can be given; these form a reliable basis on which labour cost of the work can be estimated.

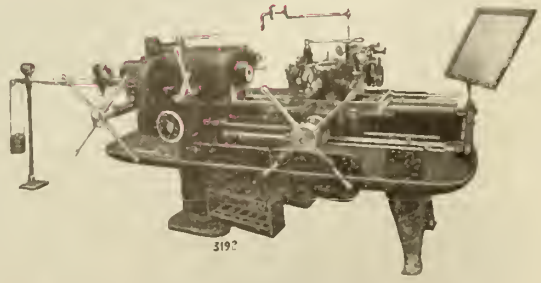
A variety of both auxiliary and general purpose machines, comprising universal tool and cutter grinders, twist drill grinders, horizontal and vertical milling machines, ball-bearing drills, precision screw lathes and measuring machines are also produced.

In addition, sole selling agencies are held for the products of many prominent British and American firms. A comprehensive range of both machine tools and small tools can thus be offered which adequately fills the requirements of the modern machine shop.

Branches and Associate Companies at:
Toronto, New York, Paris, Lyons, Lille, Brussels, Milan, Calcutta, Bombay, Yokohama, Sydney, Etc.



Ball-Bearing Drilling Machines, made with one to four spindles.

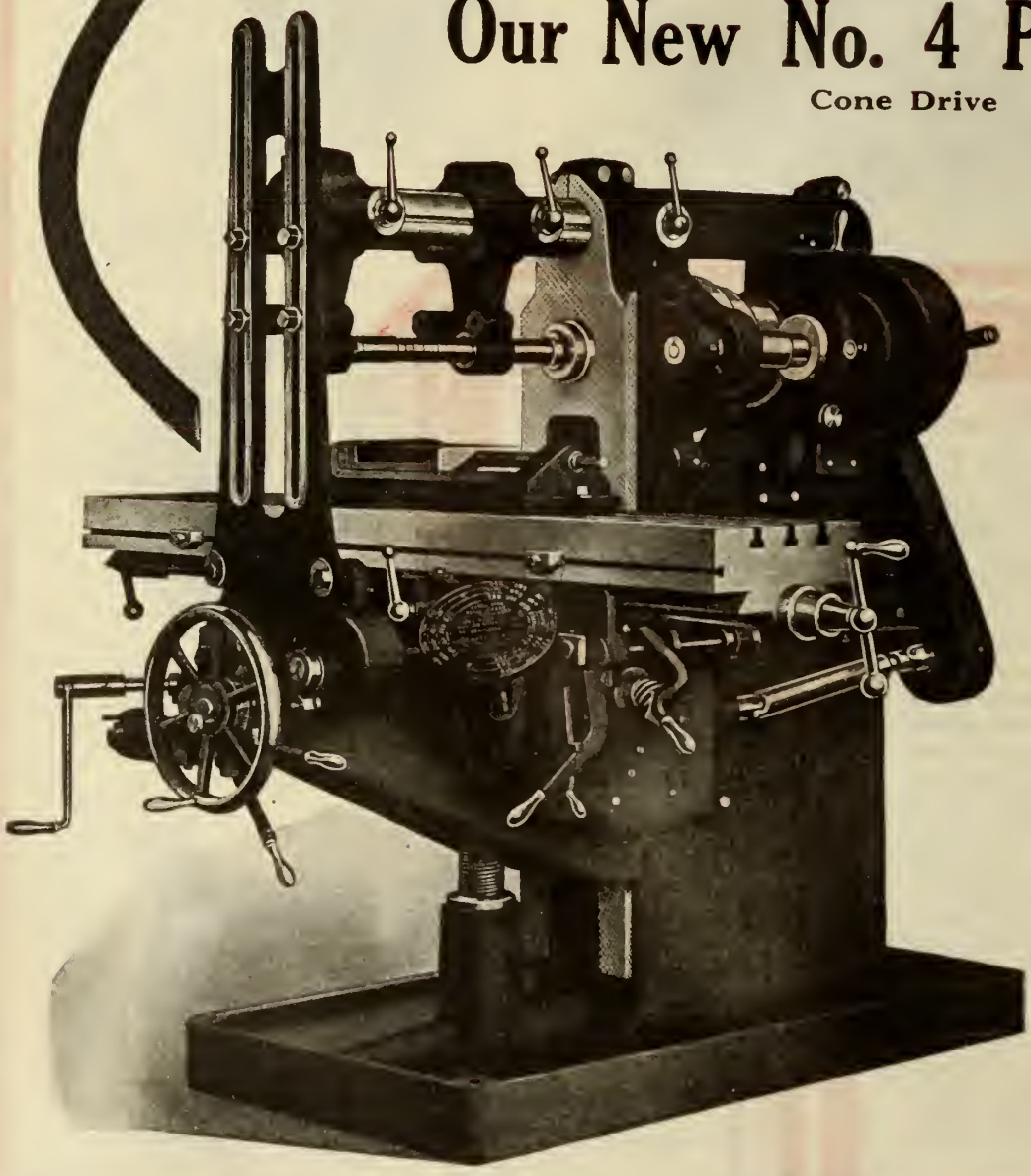


Hexagon Turret Lathes for bar work, made in three sizes for bars up to 1⅝", 2¾" and 3" diameter.

Ford-Smith

Our New No. 4 Plain Miller

Cone Drive



THIS machine may be aptly termed "the last word" in high-grade Millers. Its design includes the very latest developments to promote convenience, speed and accuracy, all of which tends to cut the cost of production in the shop.

In this new No. 4 special attention has been given to centralized control of all movements of the knee and table. Rapid power is provided in all directions and this feature, in combination with centralized control from the operator's working position at the front of the knee, makes for rapid production in all classes of work. The extreme range and coarse feeds are equal to those provided on all-geared millers.

We can hardly do justice here to the fine points of this excellent machine tool in the space we have at our disposal. Write for full description.

Plain and Universal Milling Machines



30 in. Double End Grinder



Water Tool Grinder



Light Type Floor Grinder



Swing Grinder



Buffing and Polishing Machine

FORD-SMITH GRINDING MACHINES

A Tool for Every Grinding Need

WHEN you order a Ford-Smith Grinder you can depend upon getting a machine that will give complete satisfaction. We guarantee design, materials and workmanship.

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Motor Driven Grinders, Floor Grinders, Bench Grinders, Water Tool Grinders, Swing Grinders and Special Grinding Machinery, in addition to

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Prompt Shipments from Stock

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SPECIAL, alloy and regular analysis castings produced from electric and open hearth furnace steel. Single castings up to 50 tons. All heats subject to careful chemical and physical tests.

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UNIVERSAL plate to 40" wide. Sheared plate to 60" wide. Any thickness and any length. Analysis and physical properties to meet any requirements. Two plate mills in operation assure prompt shipment of any tonnage.



AND STEEL, LIMITED

ONTARIO

WILLIAMS

PIPE MACHINES

Used Throughout Canada and British Empire

THE Williams Tool Corporation of Canada, Limited, has taken over the business of John H. Hall & Sons, Limited, Brantford, Ont., and will continue to make the Pipe Machines that made the name of "Hall" favorably known throughout Canada and the British Empire. The new company will maintain the "Hall" standard of **quality** and **service,** and will combine the features of the "Hall" and "Williams" products with the aim of keeping them the best on the market.

A Few Outstanding Features

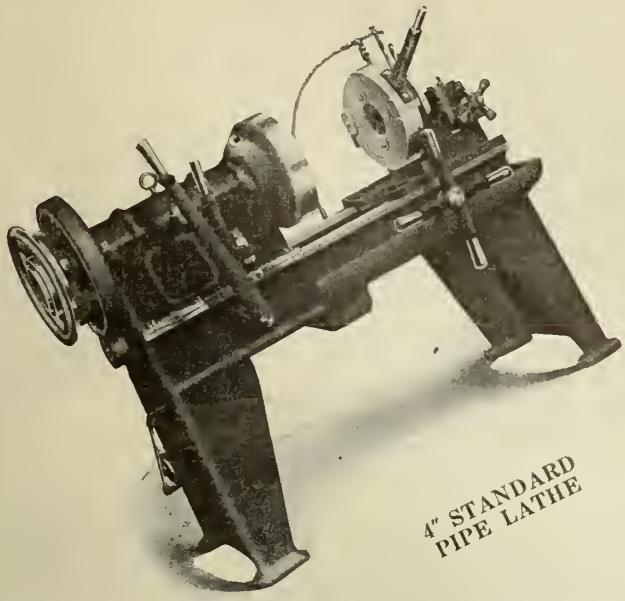
1—Single Pulley Drive, through.
2—Dodge Friction Clutch, on machine.
3—Clutch Lever at operator's left hand.
4—Rigid Bearing Bracket on drive shaft.
5—Gear Box Drive away from operator.
6—Individual Adjustment for each bearing.
7—Large Spindle Bearings are ring oiling.
8—Compact Control Levers on operator's side.
9—Large Die Cabinet and Tool Tray.
10—Substantial Oil Trough around top of ways.
11—Specially constructed Reservoir and Filterer.
12—Low-down Sliding Head.
13—Rotary Geared Pump reversible for left-hand thread.
14—Specially designed Carriage to drain off oil and cuttings.
15—All Gears amply protected.

WILLIAMS TOOL CORPORATION

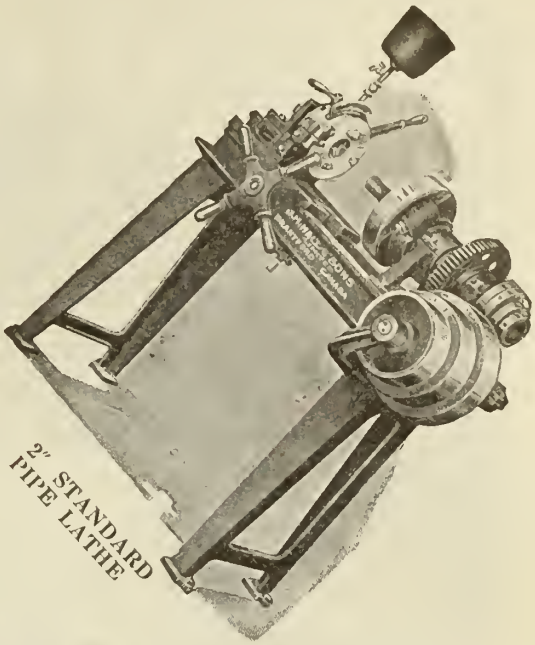
of Canada, Limited - Brantford, Ontario

Successors to

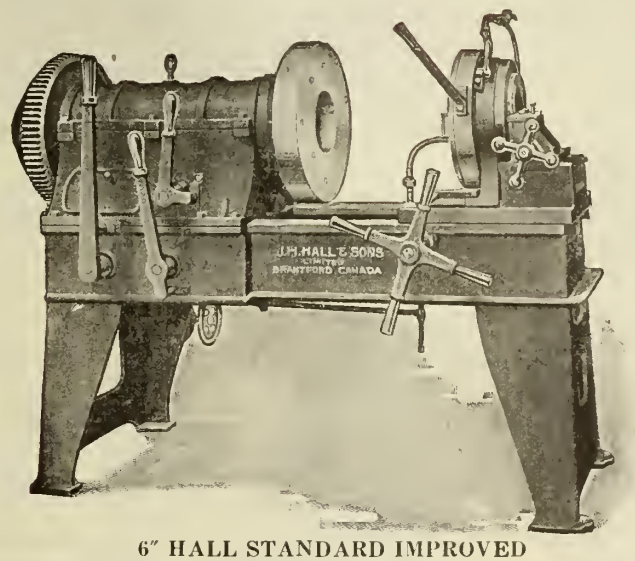
JOHN H. HALL & SONS, LIMITED



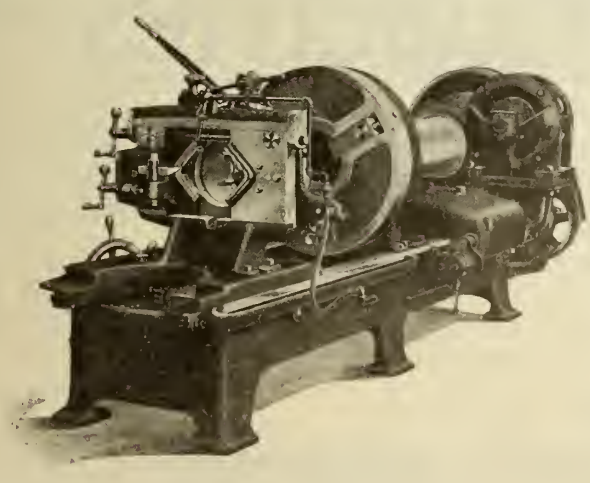
4" STANDARD PIPE LATHE



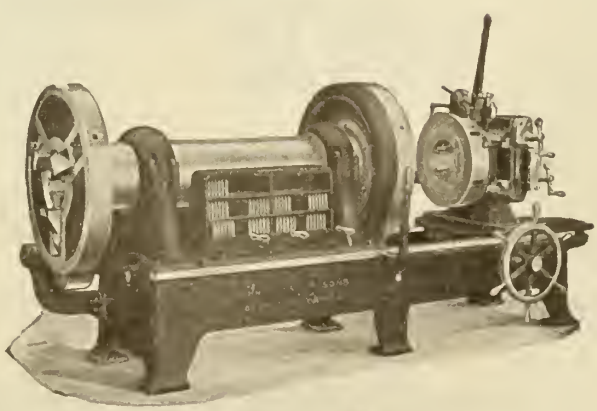
2" STANDARD PIPE LATHE



6" HALL STANDARD IMPROVED PIPE MACHINE



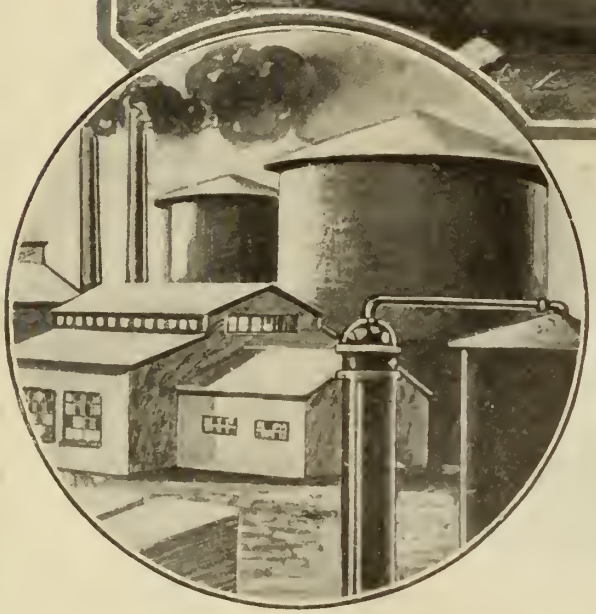
8-10-12" DUPLEX PIPE LATHE



8" HALL DUPLEX IMPROVED PIPE MACHINE

If interested tear out this page and place with letters to be answered.





This is a view of work in progress in our yards. In foreground note the gas mains for steel plants and blast furnace, and rendering tanks being loaded on a car for a packing concern. Background is oil refinery equipment.

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Tanks Riveted and Welded for
Storage or Pressure Service.
Steel Plate Work. Riveted Steel Pipe.
Bins. Hoppers. Stacks.
Boiler Breaching.
WELDING Electric and Acetylene.

ABILITY

Combined with

FACILITIES

The largest and most exacting buyers of steel plate work in Canada are among our satisfied customers. Our dependable service and high-class workmanship bring repeat orders from such firms.

We have the experience—and the facilities. We design and erect steel plate construction for every conceivable purpose—anywhere. We invite your inquiry.

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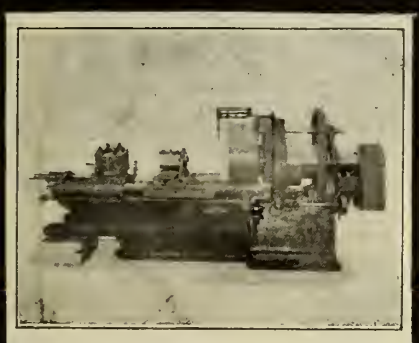
TORONTO

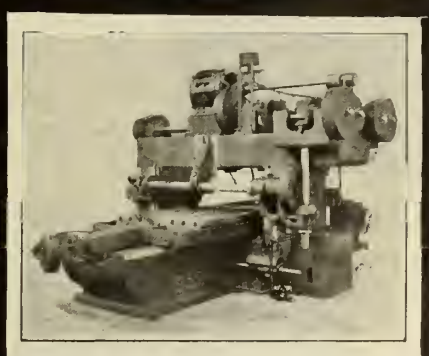
WORKS:
CHERRY ST.

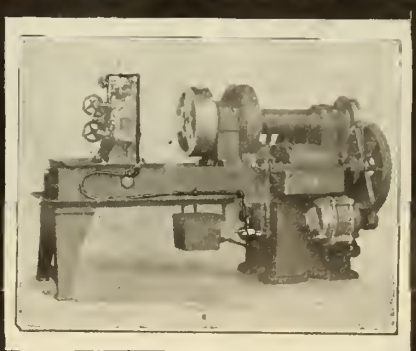
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TRAHERN









TRAHERN PUMPS are Standard

equipment on numerous makes of Machine Tools. Here are three illustrat'ons showing typical installations.

Trahern Coolant Pumps are Rotary Geared. They will pump water, oil or compound; throw heavy streams free from pulsation; operate against 100 lbs. pressure; and reverse with machines. Speed 300 to 500 R.P.M., making the pumps very long lived. Will not lose prime when properly installed.

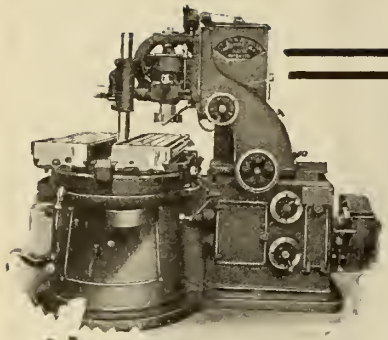
Let us send a list of firms using Trahern Pumps as standard equipment on their machines.

Prices low, delivery from stock.

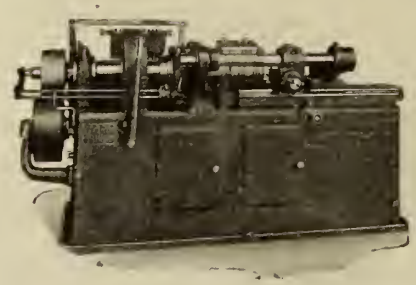
TRAHERN PUMP DIVISION

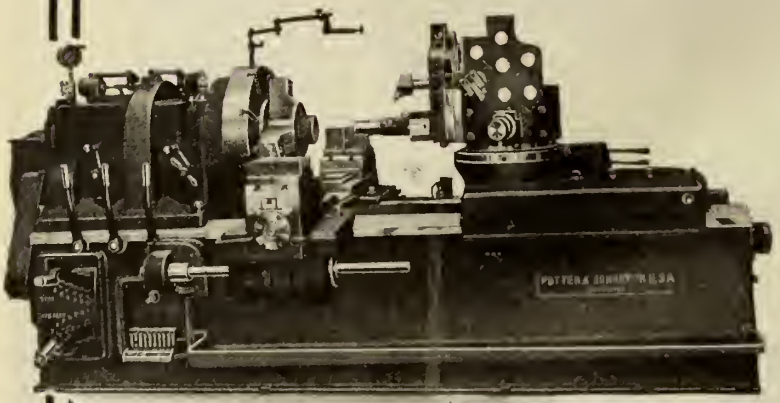
GEO. D. ROPER CORORATION

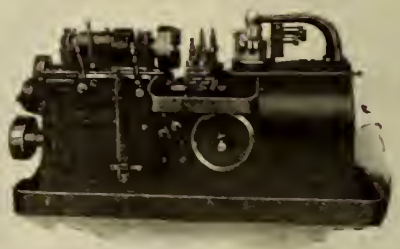
ROCKFORD, ILL., U.S.A.

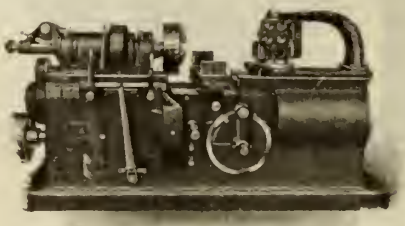


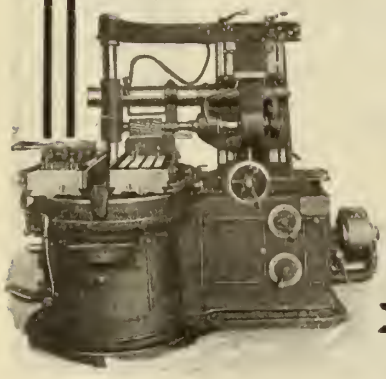
Automatic









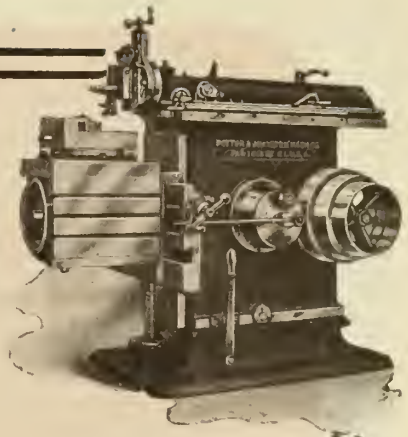


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Movements

On your production problems consider the automatic movements—an automatic way to success.

These machines have been developed so that an operator will be able to handle more than one machine, and regarding accuracy, ease of setting up the work for different operations, and mechanical construction that gives long service and keeps repairs and replacements down to a minimum the P. & J. has a record that will be doubly interesting to you.

We have shown in previous issues how the P. & J. multiplies production—how one man can run from 2 to 6 machines—how the highest standards of accuracy are met, and how costs are lowered to a low point.

But if you want to see how easy it is to set up and adjust the P. & J.'s for different jobs—you ought to visit some of the plants where they employ batteries of these machines.

Write us and we can tell you where to go to get this first hand performance proof on work like yours.



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Toronto, Ontario, Canada

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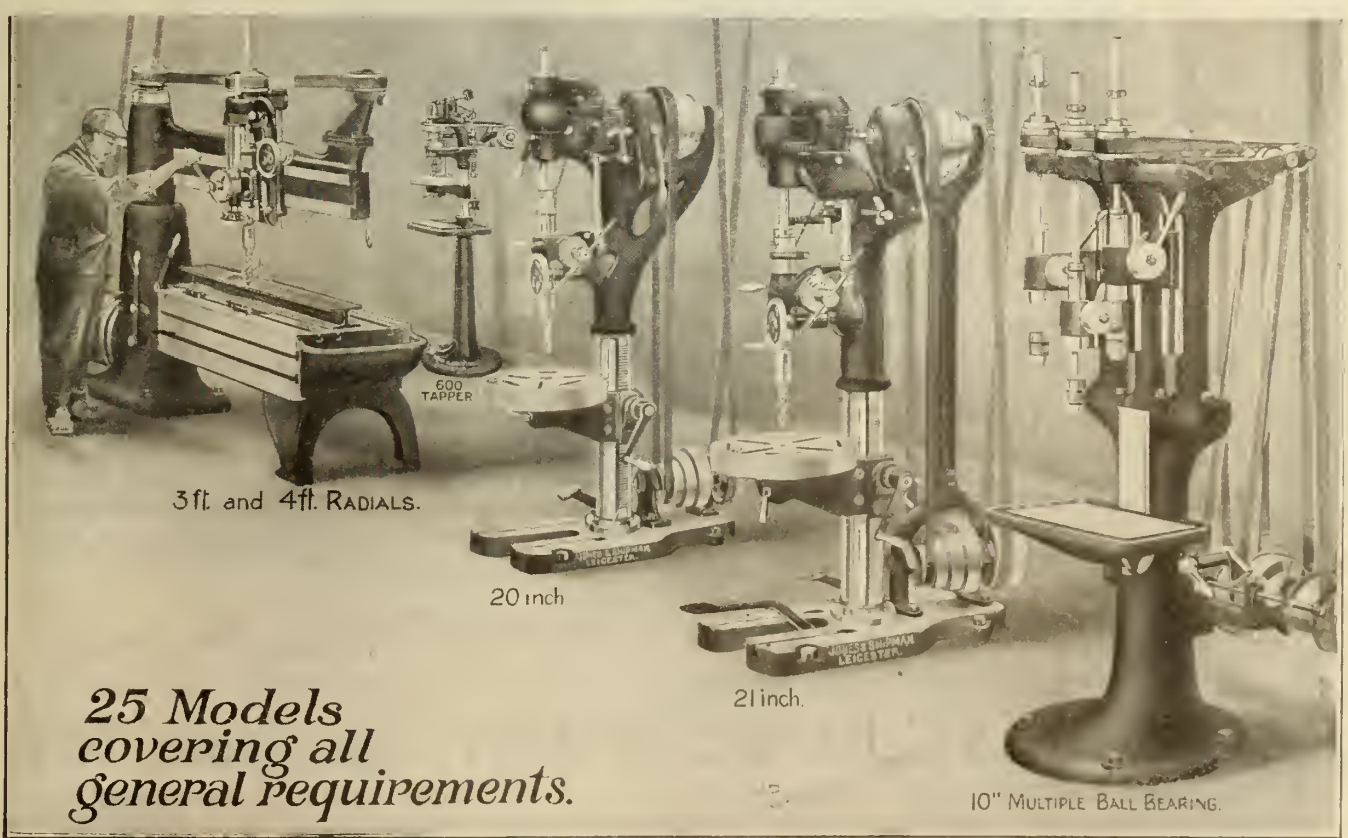
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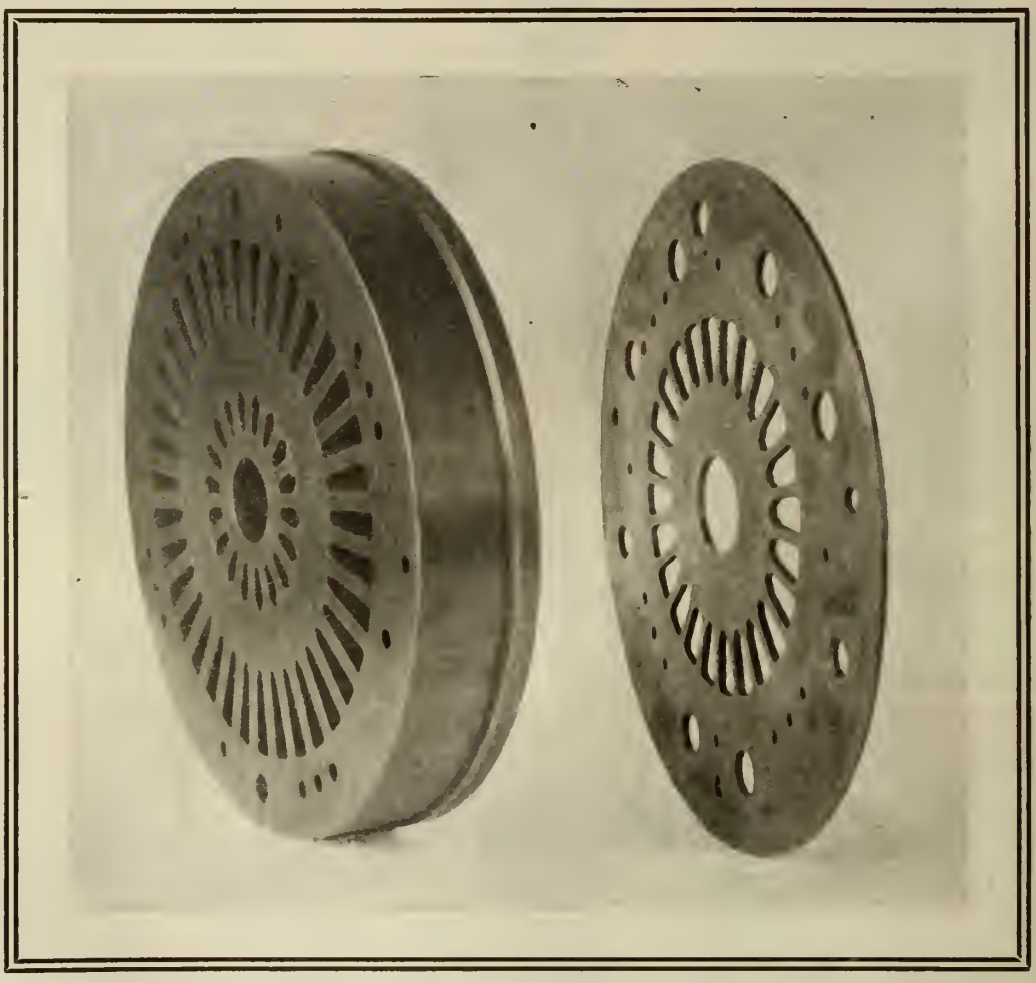
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HALCOMB "KETOS" TOOL STEEL OIL-HARDENING NON-SHRINKING



You'd Hardly Believe This Possible!

—but Facts are Facts:

THE two dies shown above are made from Ketos Steel. The new die shown to the left is 1¼" thick, the used die shown to the right is only ⅛" thick, yet it produces blanks of accuracy equal to the new one.

The used die has produced over 1,000,000 armature punchings for the Robbins & Myers Co., Ltd., Brantford, Ontario, and has been ground between 60 and 70 times.

It takes a die-maker to thoroughly appreciate this statement, and this example only proves what we have always claimed, namely, that the durability of Ketos Steel is without equal.

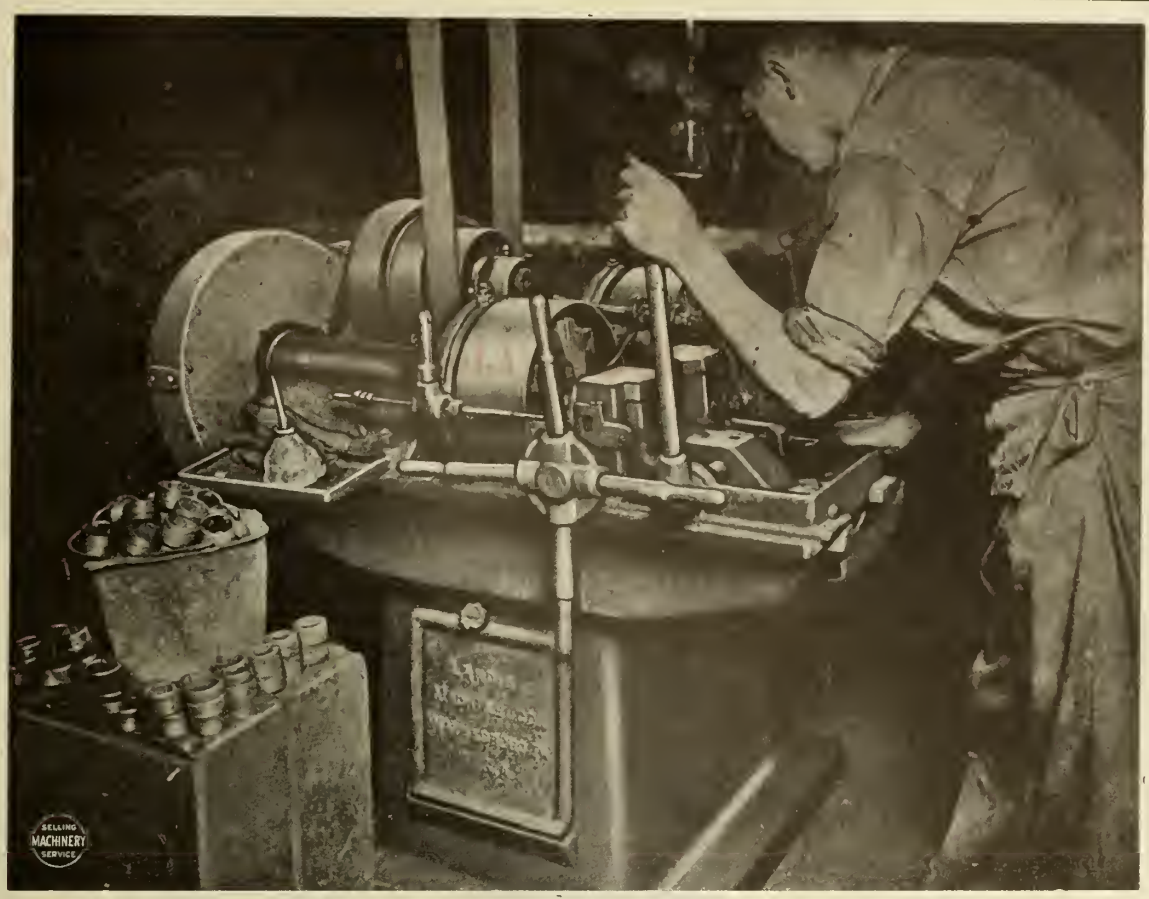
When you have dies to make, you can't go wrong if you specify Ketos as the Steel to be used. It is Oil Hardening, Non-Shrinkable, and absolutely reliable. Let us prove its worth to you!

The Ketos Blue Book is interesting, valuable and free. Send for one.

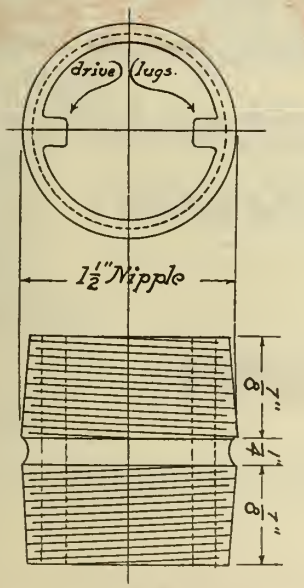
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BRANCHES: NEW YORK CITY, PHILADELPHIA, CHICAGO, CLEVELAND, DETROIT, HARTFORD

KETOS



SPEED!



The "Landis" Threads 2,000 of These Nipples Per Day

THERE is an interesting job in the line of threading nipples at the plant of the Fowler & Wolf Manufacturing Company, Norristown, Pa. The sketch shows what these nipples are and the photograph how they are threaded. One end receives a right hand and the other a left hand thread. Every one of these threaded nipples must have good, clean, full threads, because they are used on radiator work, and faulty threads would not be steam tight.

A double spindle Landis Bolt Threader is used, one side doing the right hand threading and the other side the left hand threading. Output is 2,000 nipples per day—4,000 threads.

The Landis bolt cutter has been in continuous service for the past six years, and not one cent has been spent for repairs.

Ask for the catalogue and more details of Landis Machines and Landis Die Heads.

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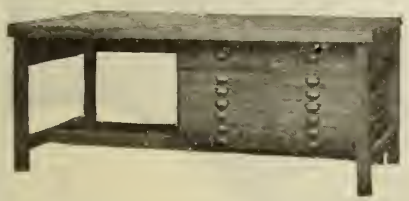
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Imperial Genuine

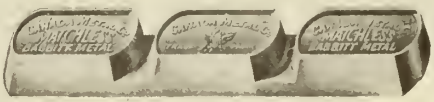
Made for extra heavy duty, such as Main Bearings on Turbine Generators, Calender Rolls in Pulp Mills, is specially adapted for Marine Engines.



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For Donkey Engines, Saw Carriages, Small Motors, Transmission Line Shafting and all steady heavy pressure duty.



Matchless

Suitable For Slow-Moving Bearings

THE CANADA METAL CO., LIMITED
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Your Orders For Metal Products

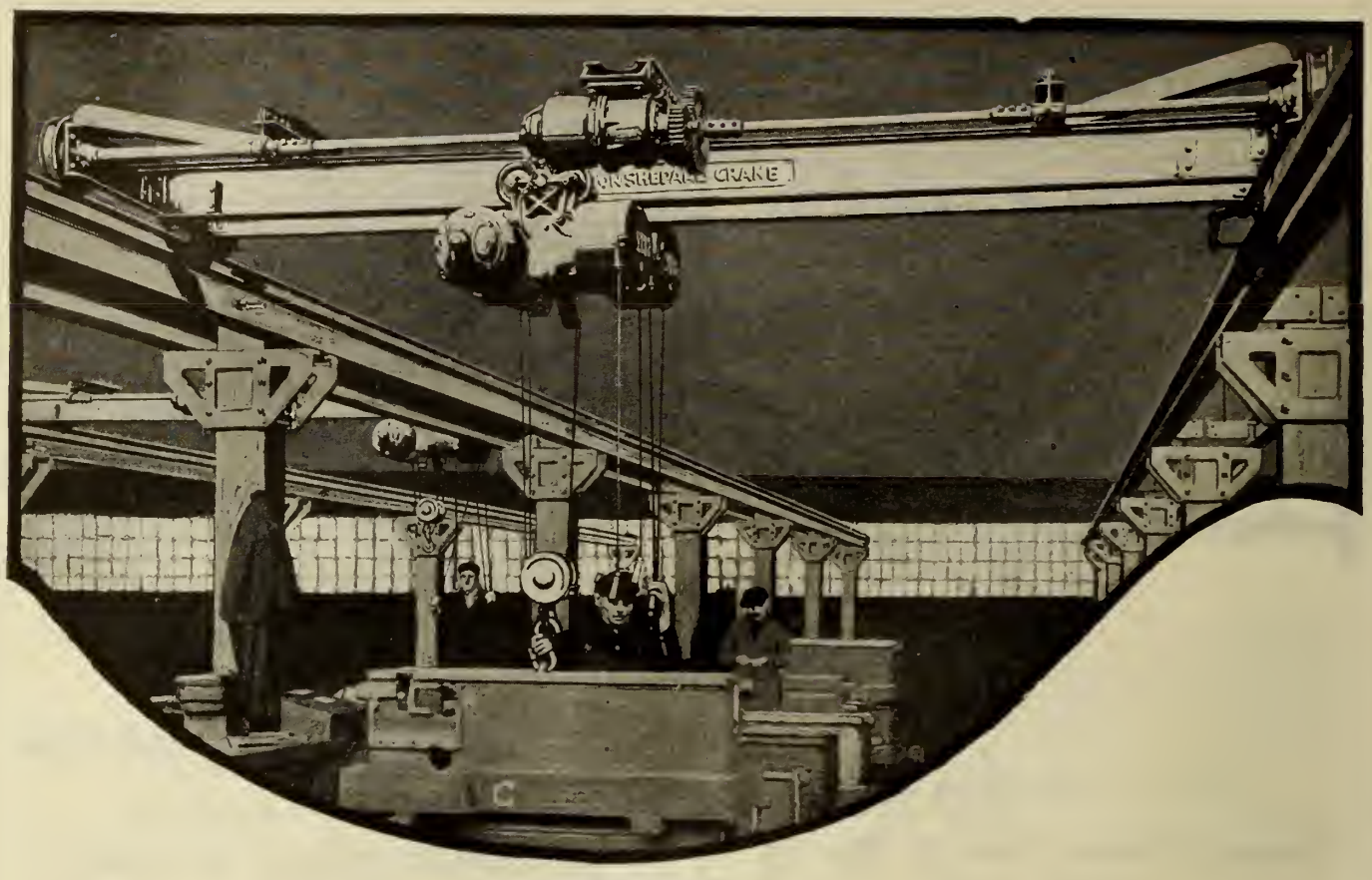
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it results in unlimited hoisting service for each department.

The Shepard Electric Crane and Hoist pictured, make possible the transferring of a load to any part of the bay. The crane covers the length. The hoist operating on the crane covers the width.

At the will of the operator a piece can be lifted and conveyed to any desired point.

Invest in "Shepard" equipment—it pays big dividends by hoisting and conveying **more** in less time, at less cost, with a fraction of the labor otherwise required.

The Shepard line includes Electric Hoists and Monorail Cranes in capacities of ½ to 30 tons; Traveling Cranes, 1 to 50 tons; and Electric Cargo Handling Equipment for docks and ships. Our engineers, competent and willing to assist, will serve you without obligating you.

Shepard Electric Crane & Hoist Co.

426 Schuyler Avenue - - Montour Falls, N.Y.

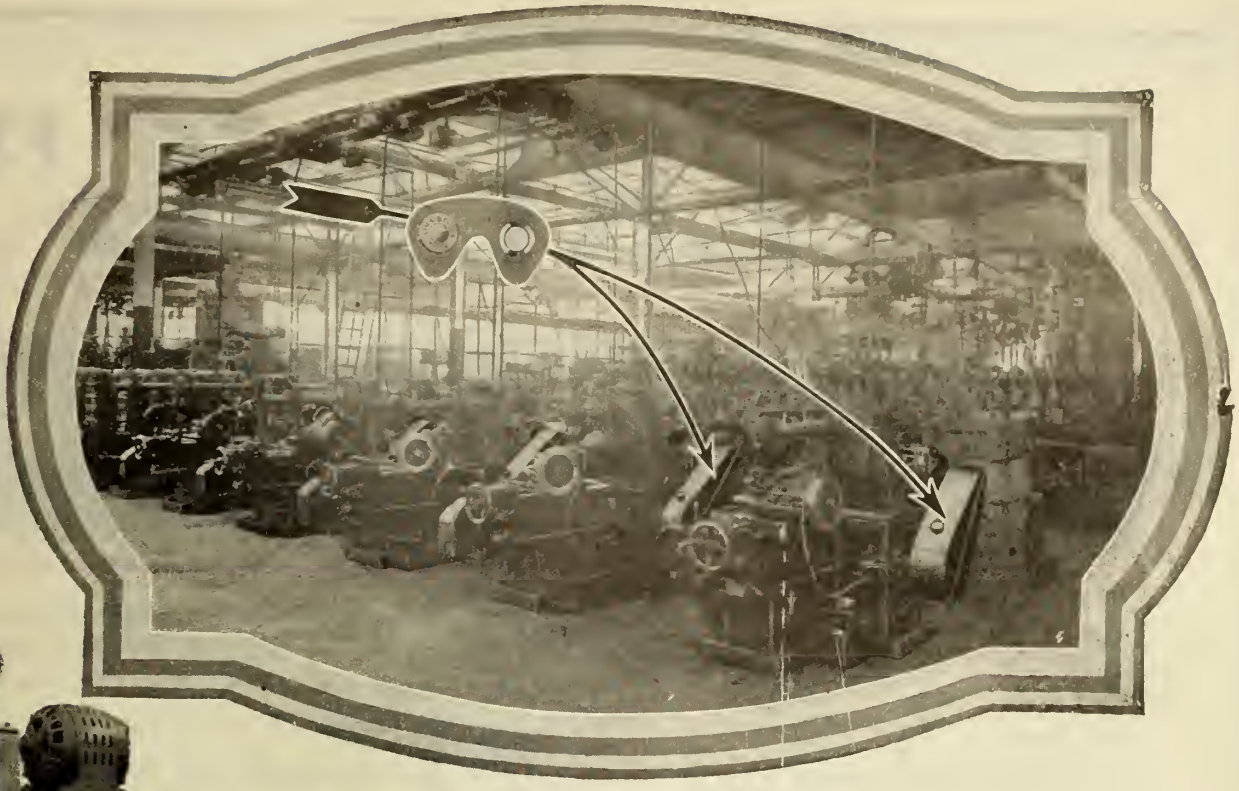
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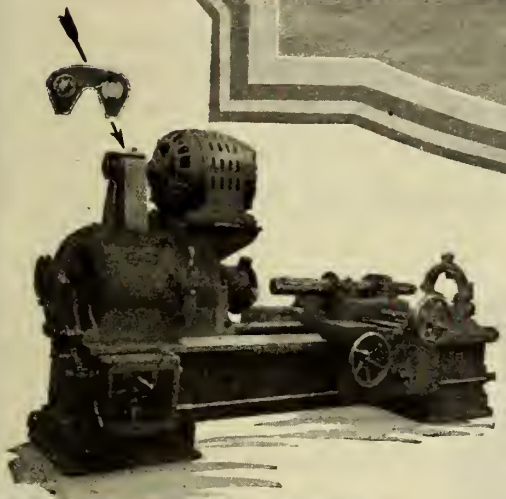
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ELECTRIC CRANES & HOISTS

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Equip Efficient Tools with Efficient Drives

HIGHLY efficient tools are purchased to perform certain operations at a lower cost.

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Link-Belt Silent Chain Drives deliver 98.2% of the power to the driven machine. There's no slippage of belts—no waiting for belt repairs—no inferiority of product due to ununiform application of power.

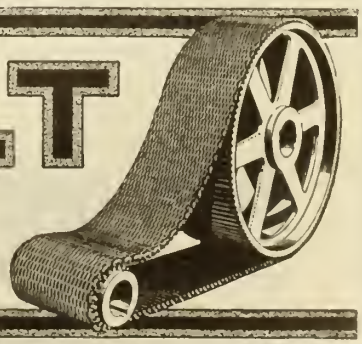
Every revolution of the motor shaft registers a like revolution of the driven shaft. Speeds are uniform. Greater speed reductions are possible. A better product results.

For Link-Belt Silent Chain Drives are "flexible as a belt—positive as a gear—more efficient than either". Write for our 40-page Machine Tool Drive Book No. 312. Shows many applications and gives full details.

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LINK-BELT
SILENT CHAIN
FOR POWER TRANSMISSION



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The man who knows says this brand of Hack Saw Blade is good—he believes there are none better. The band blades in all pitches are the best that can be made; also for power machines; they cut true, cut fast, and last long. They give real value used in any first-class machine.

This blade, combined with a "STERLING" No. 3A Improved Power Hack Saw, has no superior—it is a real winner.



"STERLING"
High Speed Power Saw

Improved Power Hack Saw Machine No. 3A.
Solid but Adjustable Frame.
Automatic Lift on Return Strike.
Plunger Pump.

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Will Be Drilled Faster and Truer

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CANADIAN-DETROIT TWIST DRILLS

CUT down the cost per hole by specifying them on your next order.

We make milled drills of all types and sizes.

We also manufacture the famous DD rolled drills, in all sizes from ½ inch to 1½ inches, specially designed for drilling drop forgings and hard alloy steel castings. The Double-D combines the strength of the forged drill with the accuracy and uniformity of the milled type. The rolling process, which we control exclusively, gives greater density to the steel, without introducing the rough inaccuracies of hammering. Try DD drills on the toughest operation in your plant and watch them "hog in."

We invite comparative tests.

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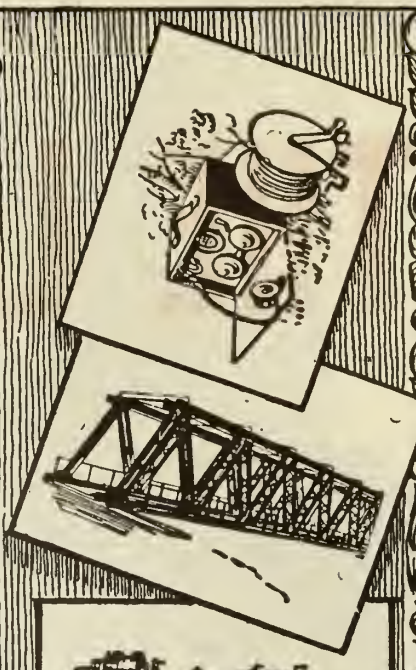
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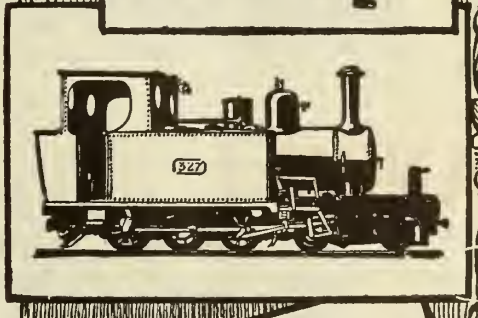
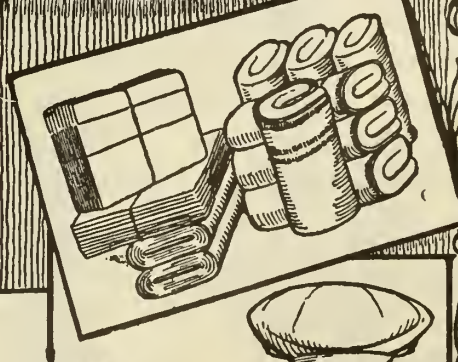
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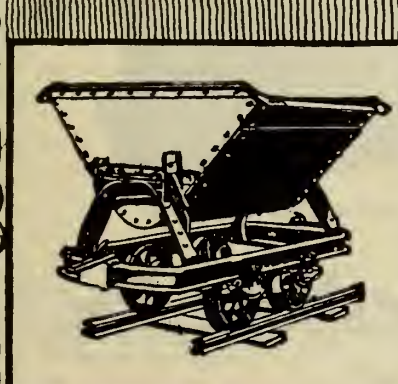
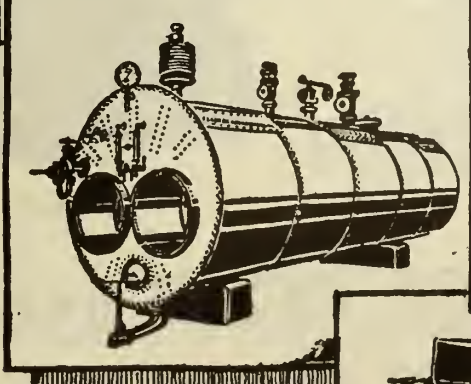
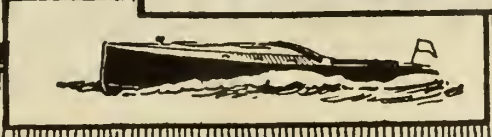
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Grinding Machines
Plain
Universal
Internal

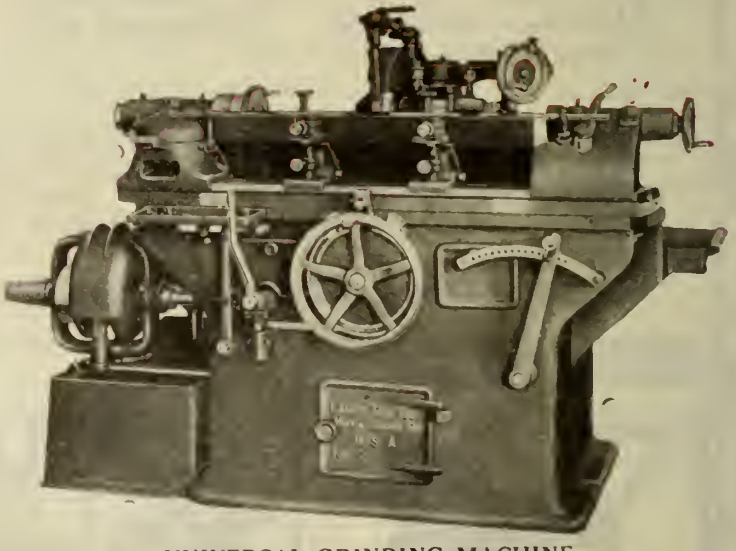
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Cam Shaft
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Piston
Roll
Gap
4-A Special
for Automotive Repair Work

LANDIS Grinding Machines and Boring Machines have created a reputation for the "making good" qualities expected of machine tools. They have been especially designed and built for efficient and dependable service, and no effort has been spared to make them as perfect as possible.

See a LANDIS in operation and you will need no further proof to convince you that LANDIS machines are essential to rapid and accurate production.

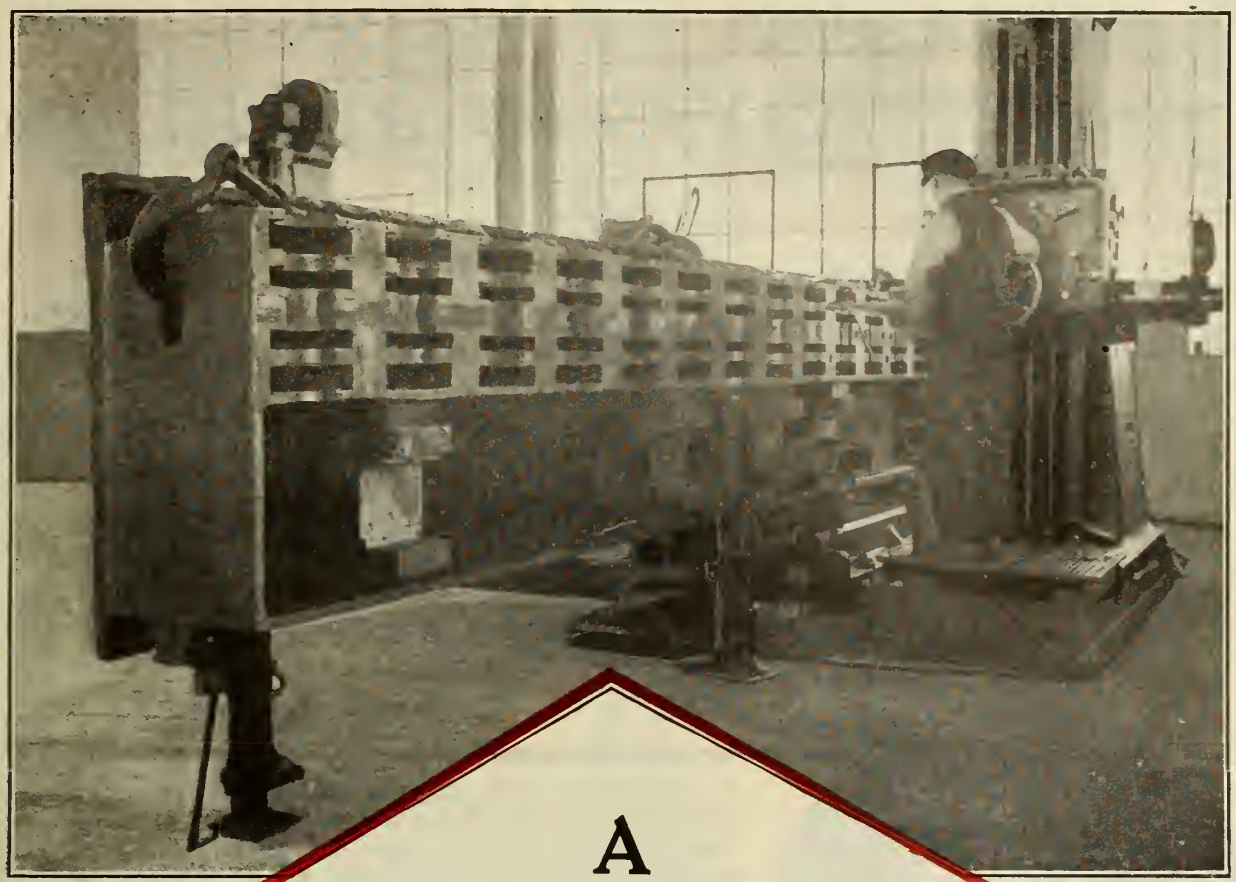
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LANDIS TOOL CO., Waynesboro, Pa.

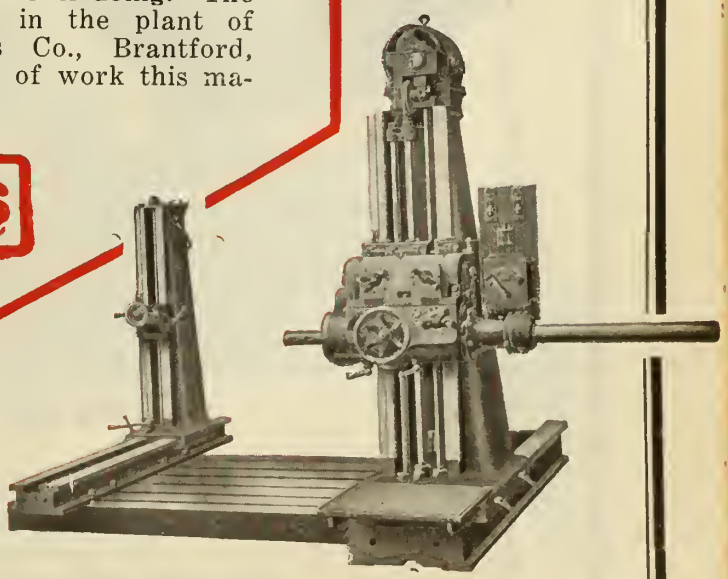
NEW YORK OFFICE: 50 CHURCH ST.



A Big Job

Boring 44 holes, 1 13-16″ in diameter in a 14 ft. section of a rolling mill table is a big job. That's what this **Landis 6 ft. Boring Mill is doing.** The photograph, which was taken in the plant of the Dominion Steel Products Co., Brantford, gives a good idea of the type of work this machine performs.

LANDIS



Horizontal Boring Machines

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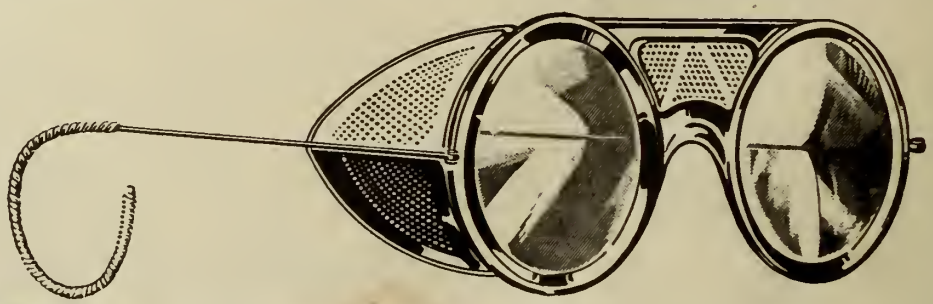
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STOCO SAFETY GOGGLES

(Pat. Dec. 12, 1916)

with

"CELOGLAS" Shatter-Proof Lenses





A safety goggle may be efficient in every other respect, but if it cannot be put on and then forgotten; if it cannot be worn day in and day out for long hours at a stretch without irritating the nose or tiring the eyes; if, in short, it is not thoroughly comfortable, it is not a practical protection glass—neither is it a STOCO Safety Goggle.

The patented one-piece front construction of the STOCO Safety Goggle, in addition to increasing the protection afforded (see illustrations) makes possible a very wide, smooth bridge, which comfortably distributes the weight of the goggle over a wide area instead of uncomfortably concentrating it on the sensitive bridge of the nose. This feature, combined with the light weight of the STOCO Safety Goggle, results in a protection glass that is truly comfortable.

Celoglas Shatter-Proof Lenses—laminated lenses which cannot shatter into the eye—are plane and practically colorless so that they cannot tire or strain the eyes. (Incidentally, STOCO Safety Goggles may be worn over regular glasses if desired.)

If you are responsible for the buying of eye protection for your shop or plant and have not yet found a really comfortable protection glass, we suggest that you try out the STOCO Safety Goggle. A request on your own or your firm's letterhead will bring you a sample by return mail. There will be no charge or obligation.

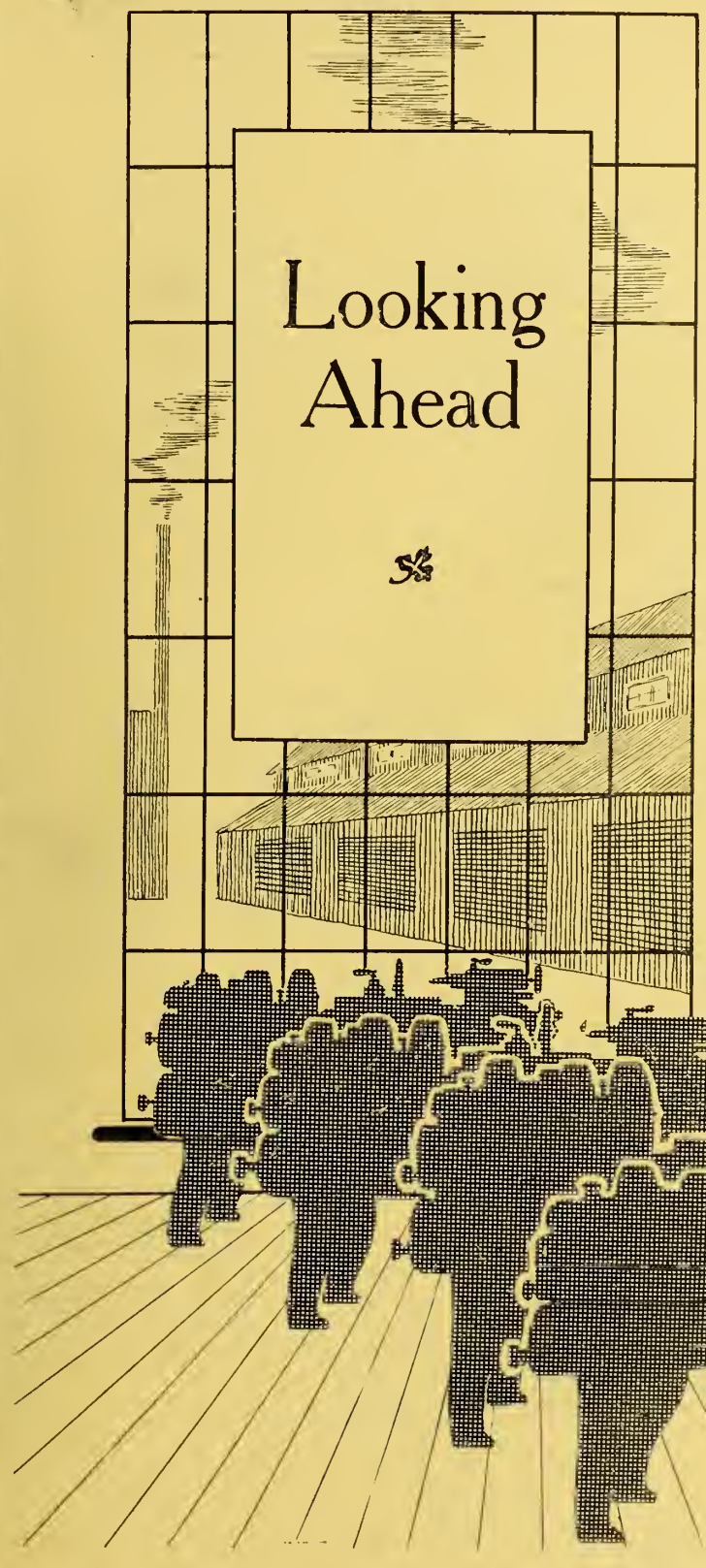
The STOCO Safety Goggle

Price Each
(F. O. B. Geneva, N.Y.)

Set with "Celoglas" shatter-proof lenses	$1.15
Set with optical glass lenses	.90

Attractive discounts for quantity orders.
Easy cable earbows or black elastic headbands at the same price.

THE STANDARD OPTICAL CO.
GENEVA, N.Y. U.S.A.



FORESIGHT is the guiding hand of every really great enterprise. This ability of looking ahead—of accurately foreseeing trade demands and conditions—has enabled Garlock-Walker to meet these demands with products exactly suited for modern requirements.

We are now on the threshold of a New Year. A year of greater accomplishments, larger undertakings! Every individual in our entire organization will be striving with but one policy, every unit of our extensive facilities will be working with but one aim—to still better the already high standard of Garlock-Walker service.

Garlock-Walker Machinery
LIMITED

32 Front St. West, Toronto
Montreal and Winnipeg

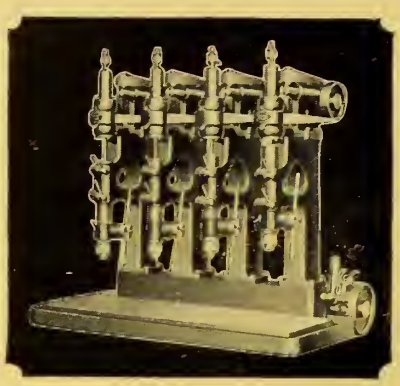
GARLOCK WALKER
HIGH GRADE MACHINE TOOLS

If interested tear out this page and place with letters to be ***answered.***

EVERYTHING IN METAL-WORKING



Cataract Bench Miller with vertical head is valuable for optical and small tool and die manufacturing.



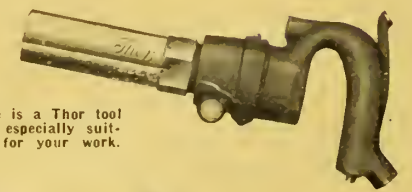
Demco Four-spindle Bench Type Drills, with the latest Demco improvements, are capable of a large volume of high quality work.



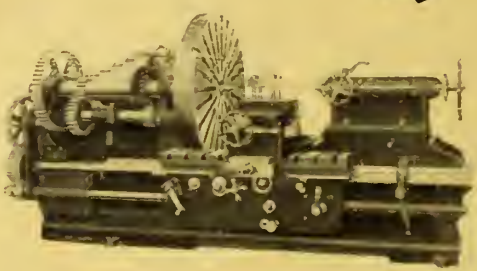
Shapers of various sizes, with single pulley or cone drive, both new and used, in stock for immediate shipment.



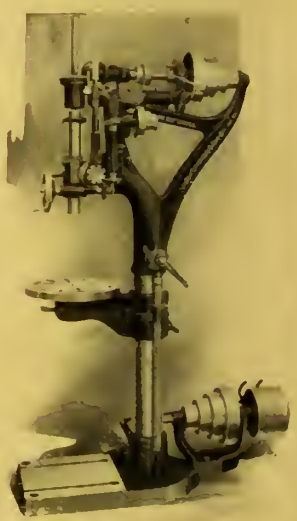
Bath Universal Grinders will do your cylindrical, internal, surface, disc and tool and cutter grinding. Write us about your grinder requirements.



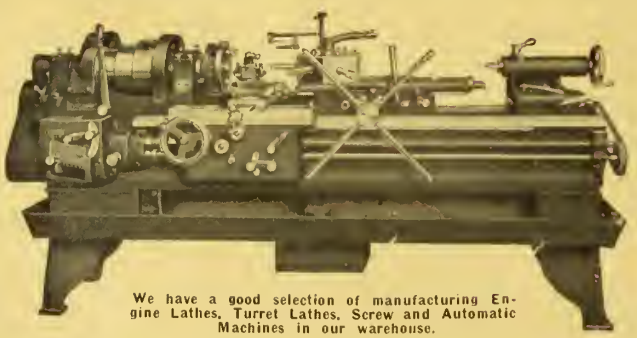
There is a Thor tool built especially suitable for your work.



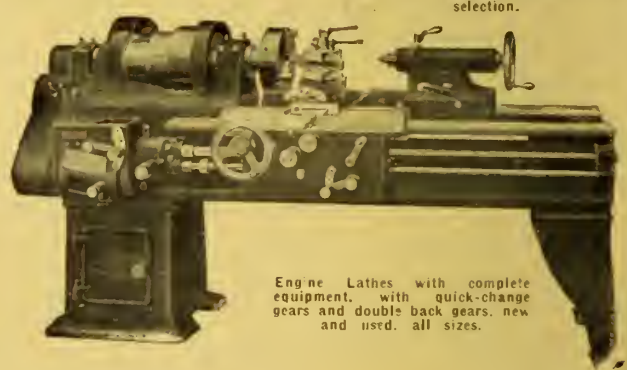
Heavy Duty and Gap Lathes up to 60" swing and of different makes, in A-1 condition, are offered at attractive prices.



Many Silver, Champion, Rockwell and other back geared drills for your selection.



We have a good selection of manufacturing Engine Lathes, Turret Lathes, Screw and Automatic Machines in our warehouse.



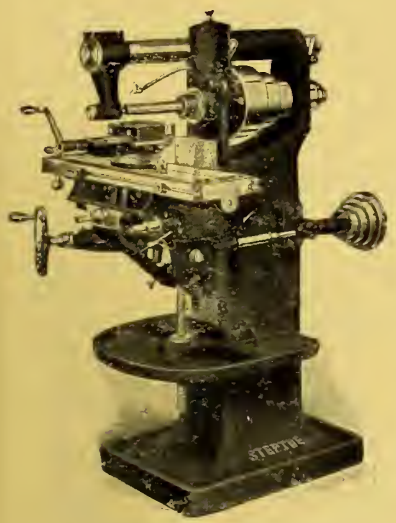
Engine Lathes with complete equipment, with quick-change gears and double back gears, new and used, all sizes.

G&W MACHINERY

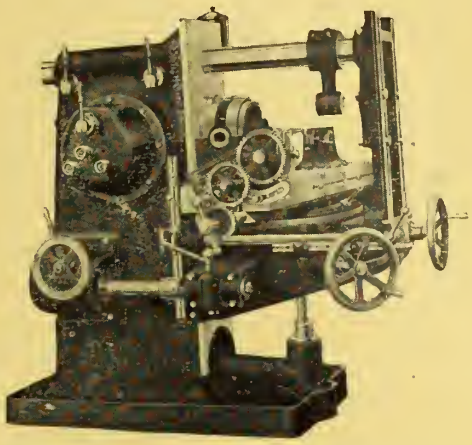
GARLOCK-WALKER

32 Front Street West, TORONTO

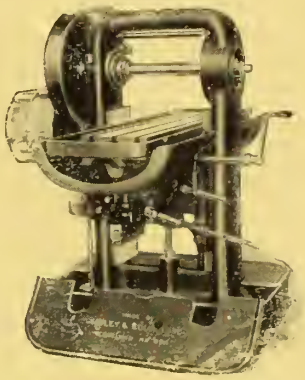
AND WOODWORKING MACHINERY



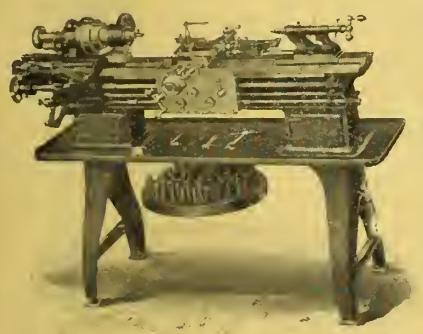
Small Milling Machines for your light work will save you money. Get our quotations.



Milling Machines, Plain, Universal and Vertical, of Cleveland, Ford-Smith, Milwaukee manufacture—sizes numbers one to four.



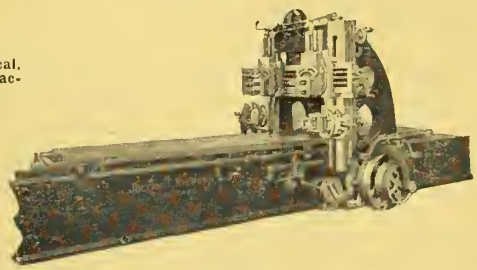
Briggs Millers, the greatest production millers ever developed. All sizes in stock.



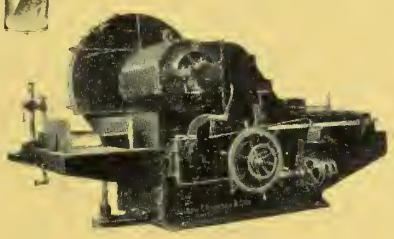
Cataract Quick Change Swing Precision Lathe, with Cone Drive. (Details in Special Catalogue).



The most powerful Air Drill made. All sizes in Toronto stock.



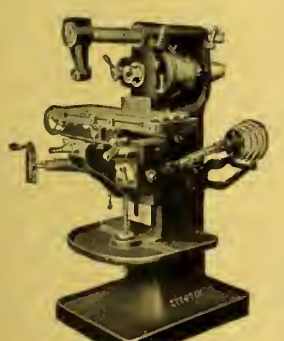
Planers, several used for immediate shipment. Standard and open side machines for good delivery.



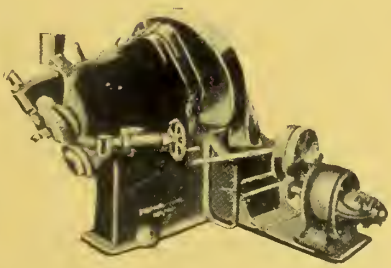
Ryerson Friction Saws for rapid cutting of steel shapes of all sizes. One No. 3, new, available at Toronto warehouse.



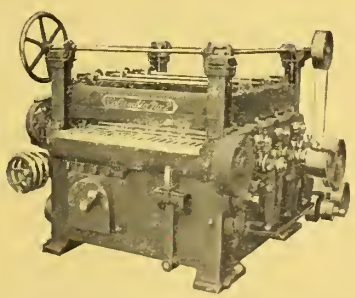
Hand Feed Jointer for your pattern shop. Sizes in stock 12" to 24".



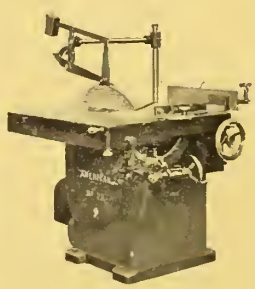
Vertical attachments for your small millers will give you a perfect tool for die and small tool making.



The Lennox Rotary Bevel Shear; the most efficient machine made for beveling irregular and curved sheets. In Toronto stock, capacity 1" plate.



Surfacers, single or double. Can be had either with or without variable feed and sectional rolls and chip-breakers.



Universal Saw Bench for ripping, cross-cutting, dadoing, mitreing, etc. Indispensable for your wood shop.

MACHINERY LIMITED

567 Banning St., Winnipeg, and 334 St. James St., Montreal

If interested tear out this page and place with letters to be answered.

GARLOCK-WALKER MACHINERY CO. LIMITED

32 FRONT ST. WEST, TORONTO TELEPHONE MAIN 5346



Interior View of Garlock-Walker Warehouse

20,000 Sq. Ft. of Floor Space Containing Every Variety of New and Used Machinery

YOU see merely a corner of our warehouse in the above illustration, but it will serve to give you an idea of the variety and extent of our line of machinery. Practically everything is found here for Woodworking and Metal-working purposes — lathes of all kinds, high speed drills, millers, planers, power hammers, electric and pneumatic tools — tools, in fact, of every description for shops large and small.

There are many used machine tools included in our exhibit, a number of them just as serviceable as new tools. It will pay you to look them over, for if they suit your purpose a considerable saving will result.

Remember this: Whether you are to personally inspect our stock or not you can place confidence in our desire and ability to furnish you with tools that will give absolutely good service. We aim to always supply our customers with machines best suited for their requirements. Success in this respect accounts for our continued and ever-growing patronage.

GARLOCK WALKER

HIGH GRADE MACHINE TOOLS

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.



"The Oil of a Million Tests"

The secret of successful scientific oil refining is painstaking care and unceasing vigilance. In making EN-AR-CO oils we average over a million tests a year. It is only by this multiplying of tests that perfect products can be made. This thoroughness in our scientific refining processes is the protection we offer to users of our products.

We manufacture En-ar-co Oils and Greases to lubricate and operate every kind and make of machinery known.

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have a reputation for perfect lubrication from the ordinary to the largest and most intricate machinery

En-ar-co Brands Stand for Quality.

Manufactured by

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Time - Trouble - Space!
Save Them This Year

DENNISTEEL
Made in Canada
SHELVING

Stronger than wood; cannot split, rot or warp.

for shops, storerooms, factories, etc., economizes floor space, saves your time and the time of your employees. It makes possible the slogan "A place for everything and everything in its place."

Dennisteel Shelving is shipped "knocked down." All that is required to erect or dismantle is a screwdriver.



DENNISTEEL
Made in Canada
Individual Lockers

offer security and privacy to your employees and promote sanitation and general well-being.

Remember! All Dennisteel Products are Fireproof!



PROMPT ATTENTION TO ORDERS

Our order department specializes in "hurry-up" orders. Our factories and branches put our products within a few hours' reach of any point in Canada. Our engineering department is at your service for estimates, layouts, suggestions.

We Also Make

Steel Cabinets, Steel Bins, Steel Lavatory Compartments, Steel Showers, Steel Dressing Rooms, Steel Chairs, Steel Stools, etc.

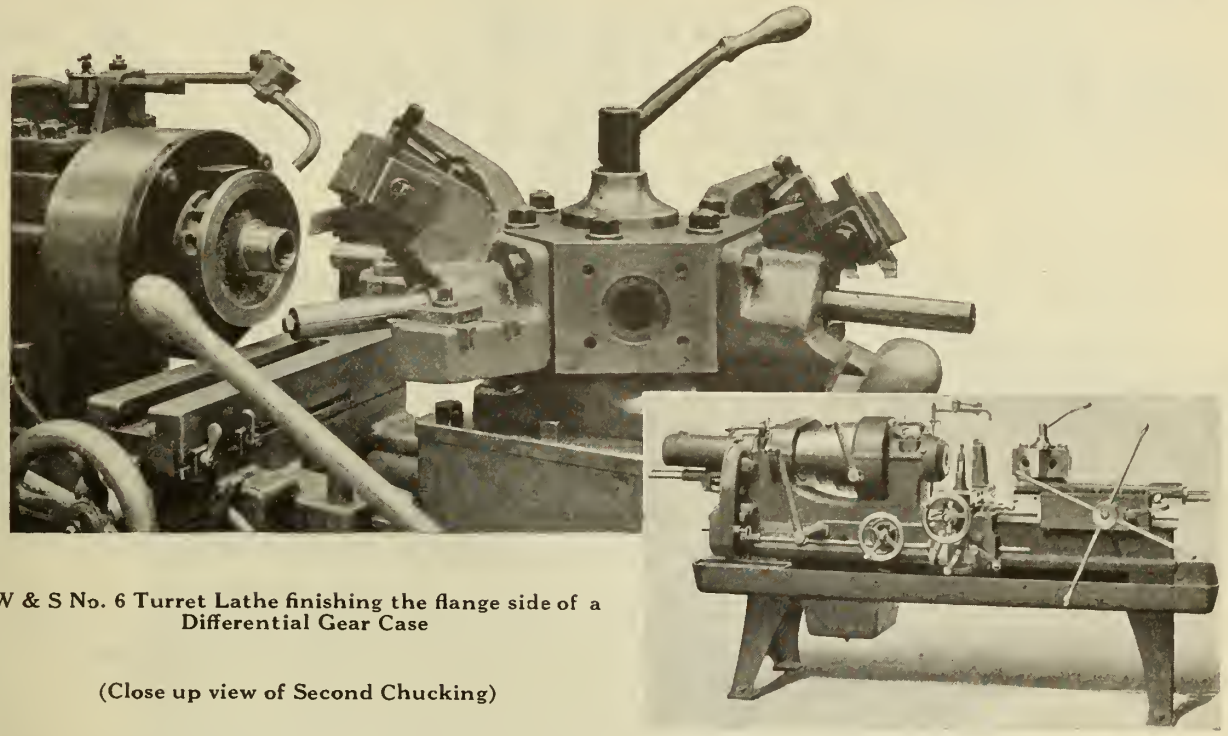
Ornamental Iron and Bronze, Commercial Wirework of all kinds, General Builders' Ironwork.

Write for Folders

THE DENNIS WIRE AND IRON WORKS CO. LIMITED
LONDON
CANADA

HALIFAX MONTREAL OTTAWA TORONTO HAMILTON WINNIPEG CALGARY VANCOUVER

Everyone Considers Price



W & S No. 6 Turret Lathe finishing the flange side of a Differential Gear Case

(Close up view of Second Chucking)

Of course everyone considers price. And a thing is expensive or not in proportion to its value to you.

When a machine is built in such a way that it delivers service to you year after year without ceasing, it's worth something.

When a machine is built in such a way that its accuracy lasts year after year, you want to know about it.

When this accurate, durable machine produces your work faster and better than any other machine on the market, your costs go down and you know your investment in that machine is a paying one.

Warner & Swasey Turret Lathes are built just that way. We'd be glad for a chance to prove it to you—write us.

World's Largest Manufacturer of Turret Lathes and Turret Lathe Tools.

The Warner & Swasey Company

CLEVELAND, U.S.A.

BRANCH SALES OFFICES: New York: Singer Building Boston: Oliver Building
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Elliott & Whitehall
Tool Company
GALT



The Home of Good Tools

You see here one of the best heat treating plants in the country. It is equipped throughout with the most modern machinery, and engineered by men who thoroughly understand their jobs. In this plant **Elliott & Whitehall** jigs and fixtures are designed and constructed. They are made of the exact materials and according to the exact specifications that you want.

Some Tools We Make:

Milling Cutters and Small Tools, Jigs, Gauges and Stamping Dies

Note Reference to Jigs and Fixtures on Opposite Page.

ELLIOTT & WHITEHALL TOOL CO., Galt, Can.

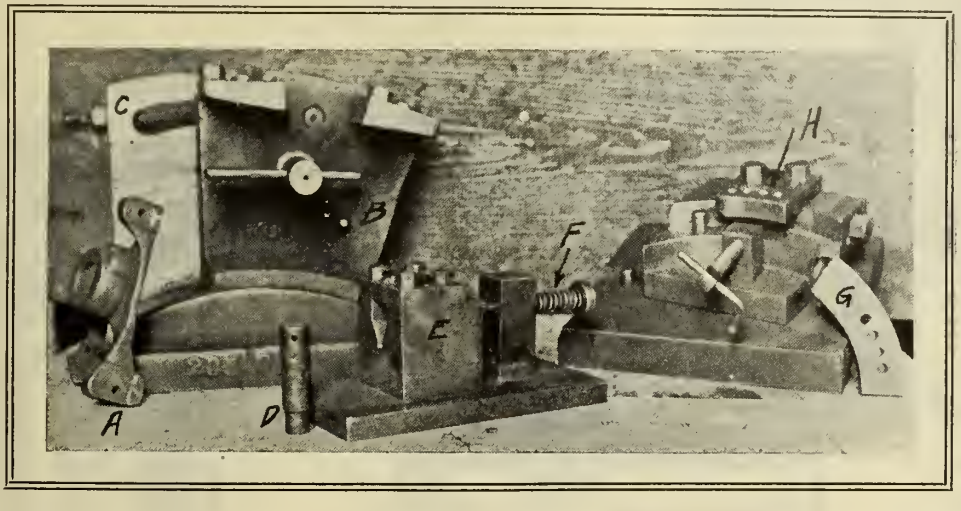
Eastern Representatives: Yeates Machinery and Supply Co., Montreal

E. & W.

Jigs and Fixtures

For Real Service

YOUR particular attention is called to our **Jigs** and **Fixtures.** These are the result of years of specializing in this line. For real service you will find none better than those from the Elliott & Whitehall shops. Proof of these statements is evidenced by the many letters we receive from enthusiastic users. We will be glad to refer you to any of these.



Here is an example of the work of Jigs and Fixtures. They are used with much success by the plants turning out agricultural machines. We also cater to practically all the automobile plants in Canada on metal stamping dies, also jigs and fixtures, which are not only ideal for this type of work but are proven successes in many other lines.

Small Tools

And what is true of our Jigs and Fixtures is equally true of our **Milling Cutters and Small Tools.** Our list includes Plain and Side Milling Cutters, Inserted Tooth Cutters, End Mills, Interlocking Side Cutters, Angular, Concave and Convex Cutters, Gear Cutters, Hand Reamers, Checking Reamers and many others.

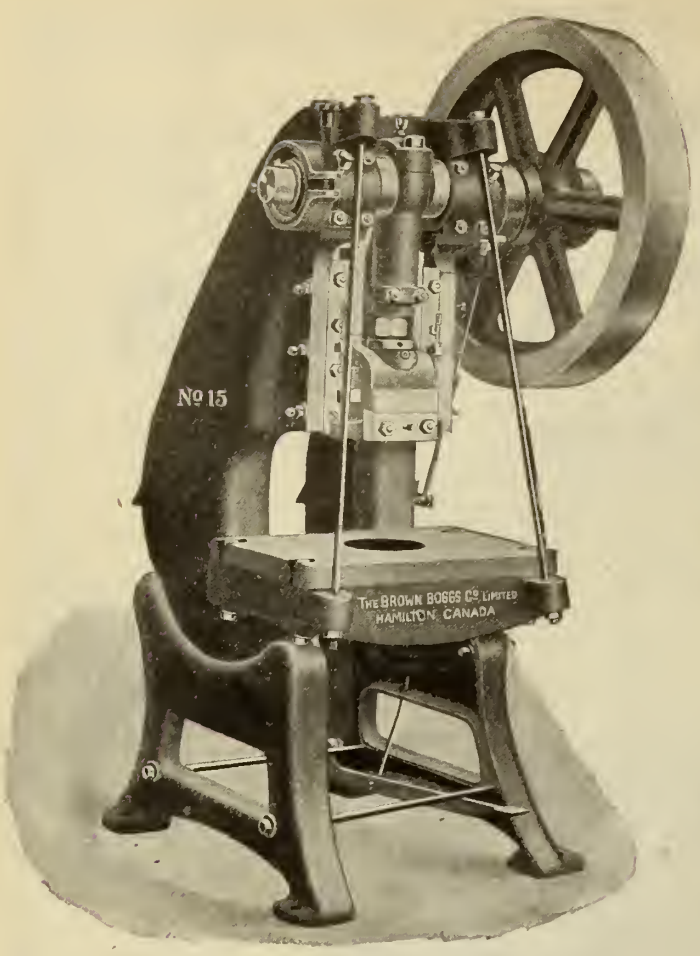
Send for our catalogue. It is replete with full specifications and details and tells all about this line of superior quality and service. Constant reference to it will increase shop efficiency.

ELLIOTT & WHITEHALL TOOL CO., Galt, Can.

Eastern Representatives: **Yeates Machinery and Supply Co., Montreal**

If interested tear out this page and place with letters to be answered.

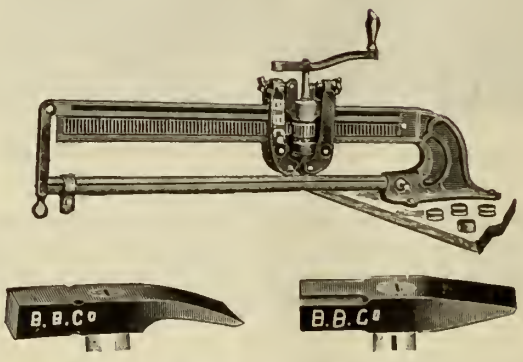
Bro Sheet

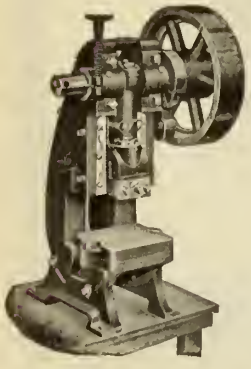


No. 15—Power Press

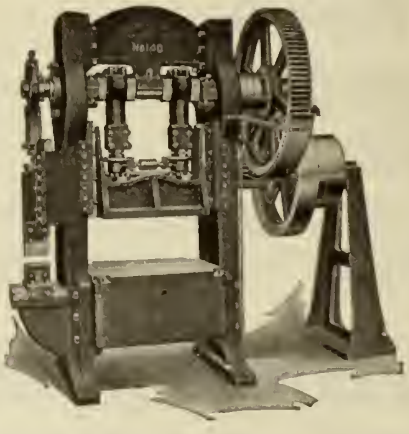
B B Co Ltd.



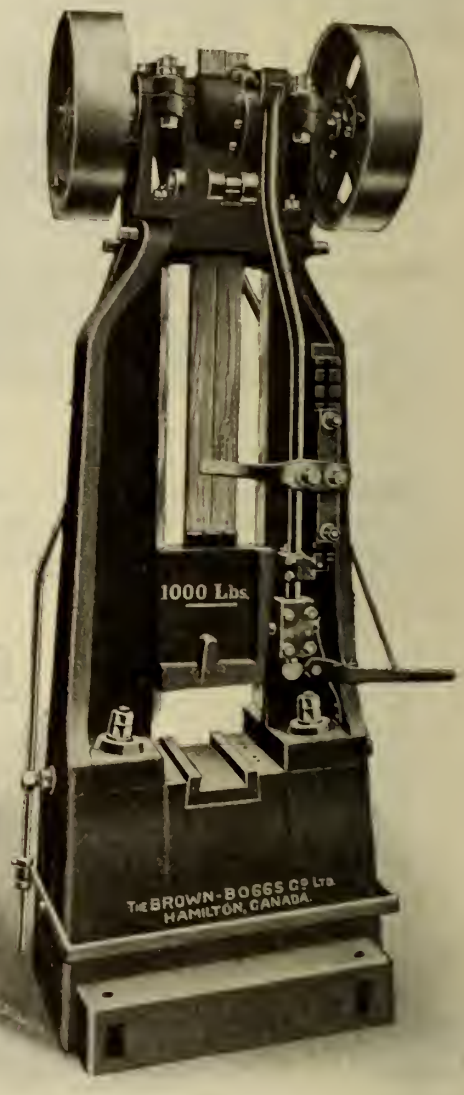




No. 10—Bench Press



No. 140—Double Crank Trimming Press



1,000 lb. Board Lift Drop Hammer

wn-Boggs

Metal Workers' Tools

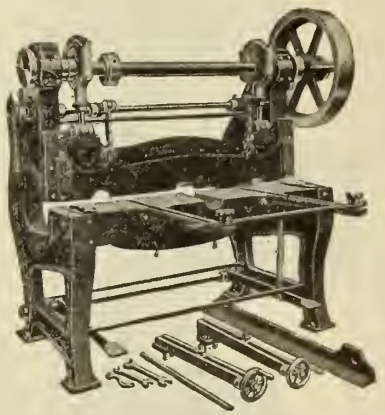
Steady, Continuous Operation Makes Volume Production

Spurts of speed will not make up the output lost through breakdowns. The steady, continuous operation of efficient machinery means a volume which cannot be equalled by any other means.

When you buy machinery, choose that which has a reputation for giving long, satisfactory service.

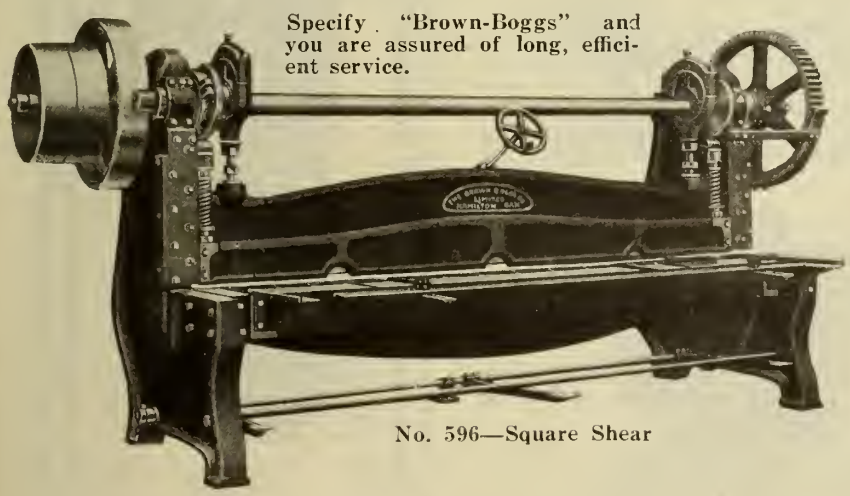
The service which Brown-Boggs products render their many users is ample proof that every machine leaving the Brown-Boggs factory is thoroughly dependable.

The "B-B" line comprises Tinsmiths' Tools and Sheet Metal Working Machines of every description; Canners' and Evaporators' Machinery, Shears of all kinds, Power Presses for Punching, Forming, Embossing, Blanking, etc.

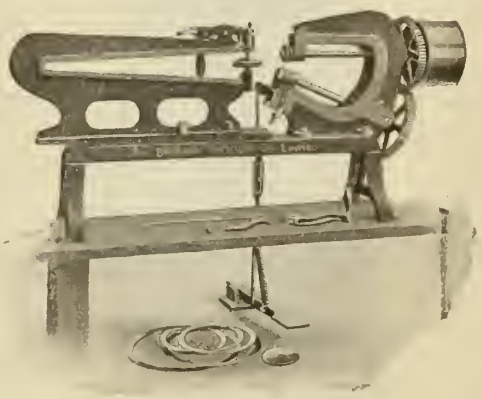


No. 449—Shear

Specify "Brown-Boggs" and you are assured of long, efficient service.



No. 596—Square Shear



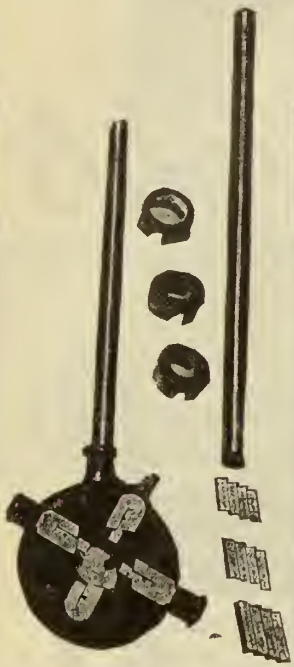
No. 36—Ring and Circular Shear

The Brown-Boggs Co., Ltd.

Hamilton :-: Canada

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JARDINE



No. 1 A Toledo Pipe Stock



Canadian Giant Power Hammer.

REGISTERED J TRADE MARK

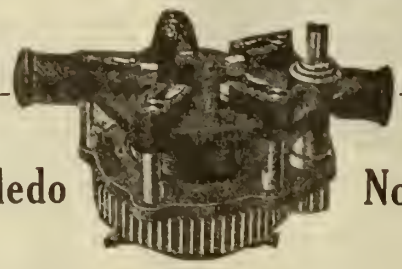
Sole Makers of "Jardine" Pipe-Threading Tools

Machinists' Blacksmiths' Boiler-Makers' and Pipe-Fitters' Tools

WHEN you purchase these MADE IN CANADA tools you pay no duty, nor exchange rates, and you get tools correct in design, high in quality and efficient in service.

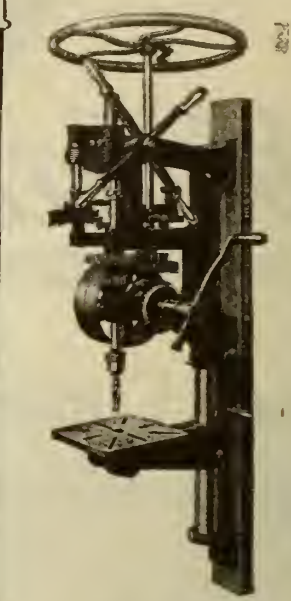
Catalog No. 17 covers our Machinists', Blacksmiths' and Boiler-Makers' Tools. Catalog No. P3 our Pipe-Fitters' Tools. Which one shall we send you?

Sole licensees to manufacture and sell Toledo Pipe-Threading Tools in Canada.



Toledo No. 2

Geared Adjustable Threading Tool.



No. 6 Hand and Power Drilling Machine.



No. 3 Horseshoer's Vise and Bolt-Header

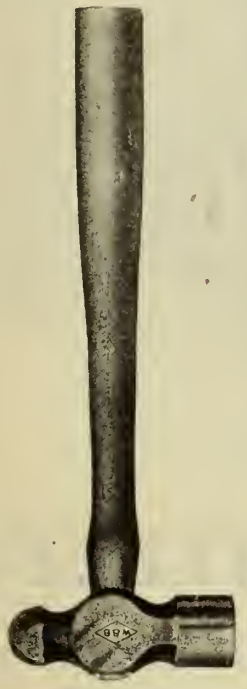
A. B. JARDINE & CO., LIMITED, Hespeler, Ont.

Agents: Winnipeg and West—Stanley Brock, Ltd., Winnipeg, Man. Brockville and East—J. R. Devereux, 358 Beaver Hall Square, Montreal. Belleville and West—W. H. Cunningham & Co., 269 West Richmond St., Toronto, Ont.

Foundry, Factory, Machine Shop and Construction Supplies

RICE LEWIS & SON LIMITED TORONTO

HARDWARE



WE carry a large and varied stock of manufacturers' supplies, ready for immediate shipment, so you can be reasonably sure of prompt deliveries on all orders for foundry, factory, machine shop and construction supplies.

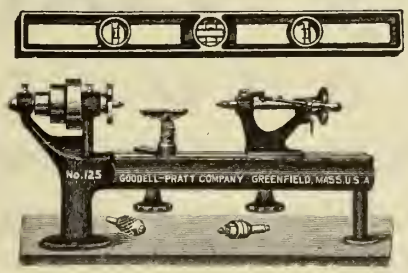
For seventy-three years our products have been well and favorably known to users of hardware and metal supplies throughout Canada. We handle only reliable lines and endeavor to render satisfactory service to all our customers.

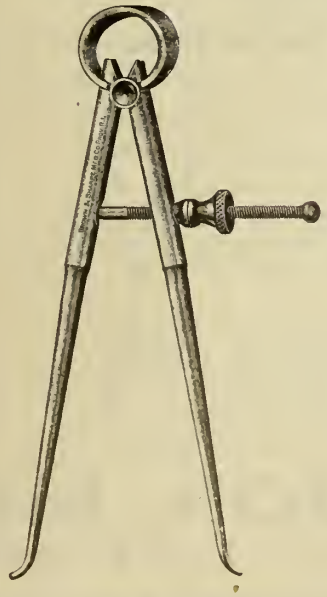
We shall be glad to quote prices and dates of delivery on such of our lines as interest you.

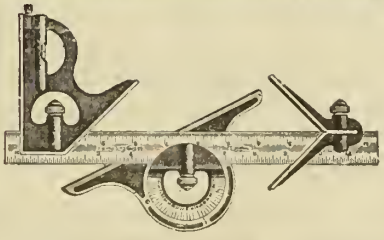
RICE LEWIS & SON, LTD.

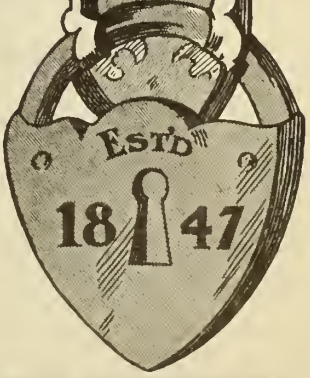
Established 1847

19 Victoria St. - Toronto, Ont.



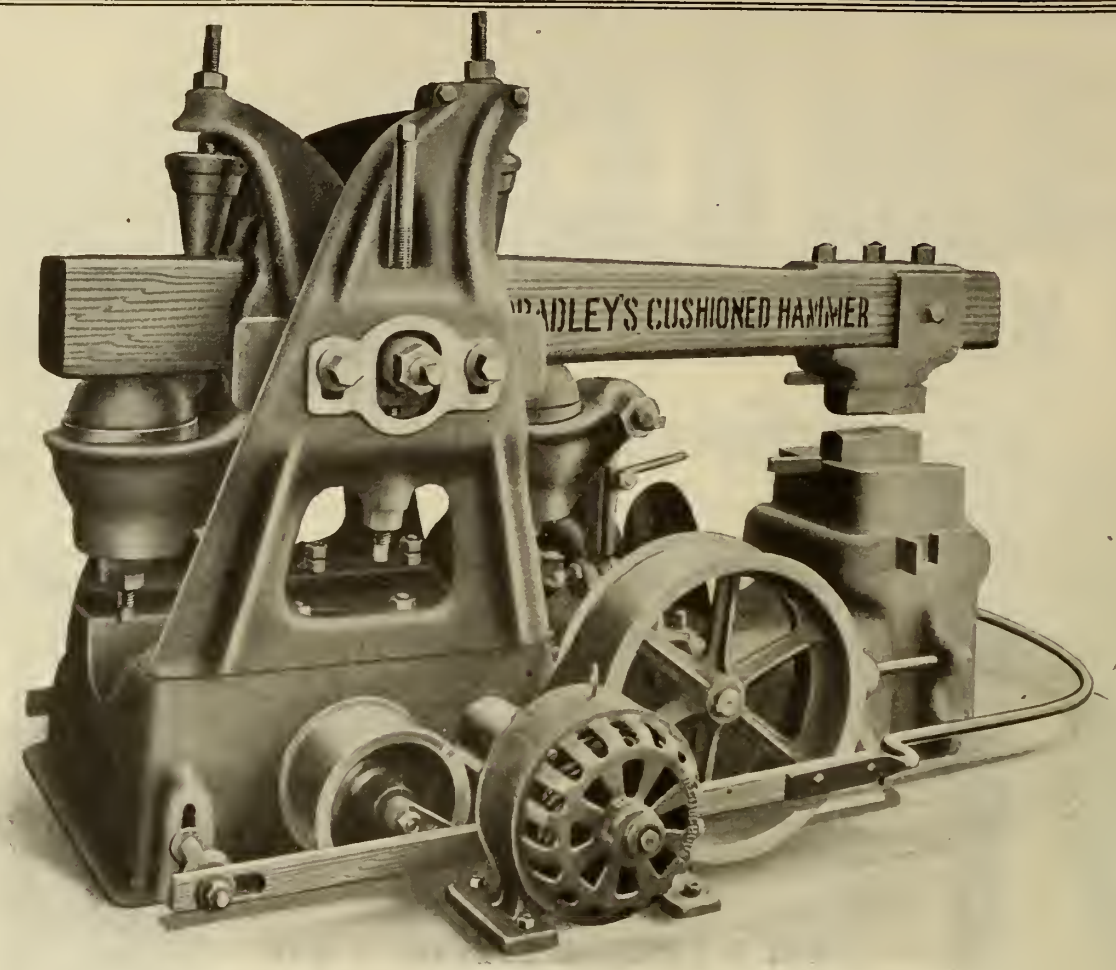








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Bradley Hammers

for production —

25% and even greater has been the reported production increase in many instances.

Not only that, but Bradley Hammers stand up five, ten, twenty, thirty and even forty years, giving *continuous* service under the most severe conditions. They always assure *greater production,* more speed and *absolute accuracy*—because Bradley Hammers never fall down. For over 47 years Bradley Hammers have pounded out efficiency in hundreds of forge shops in America.

Made up in four styles—Bradley Cushioned Helve Hammer; Bradley Upright Strap Hammer; Bradley Upright Helve Hammer; Bradley Compact Hammer.

Let us convince you as we have convinced others.

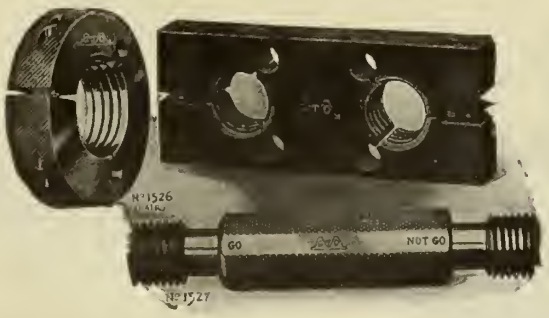
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Norway, Sweden, Denmark—Chr. A. Herstad, Copenhagen, Denmark
Belgium—Fenwick Freres & Co., Liege
Brazil—Fenwick Freres & Co., Rio de Janeiro.
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"Made in Canada"

"*Little Giant*" SCREW PLATES

"Little Giant" Screw Plates are recognized as standard equipment for threading repair work for garages, machine and repair shops, factories, farms, ships, construction camps, motor truck fleets, etc. There is an assortment for every screw-threading need.

GTD TAPS and DIES

Noted for their excellent workmanship, easy-cutting and long-wearing qualities. **"Gun"** taps and **"Acorn"** dies will increase production and cut costs.

GTD GAGES

Made with infinite care and skill. Accurate to the closest manufacturing tolerances. Complete gaging systems designed for any product.

GREENFIELD TAP AND DIE CORPORATION
OF CANADA, LIMITED GALT, ONTARIO

Successors to

WELLS BROS. CO. of Canada, Limited

Greenfield Tap & Die Corp. of Canada, Ltd., Galt, Ontario

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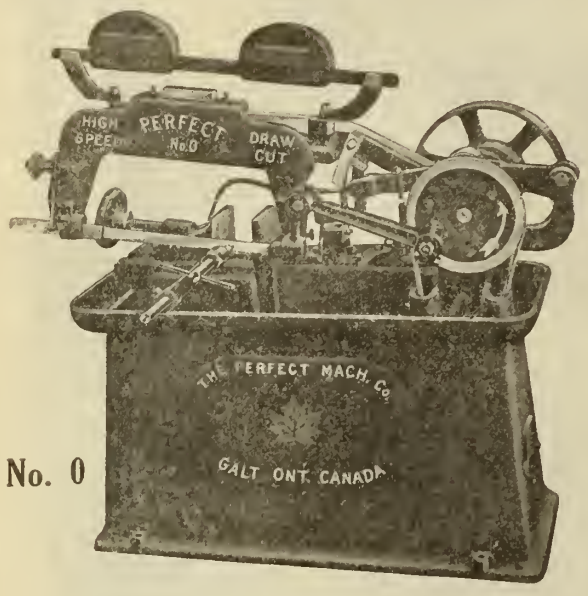
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CM1006

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PERFECT MACHINES



No. 0

THE NEW PERFECT DRILL

will be ready for the market in 30 days.

LIGHT 20-INCH
BACK GEAR
POWER FEED

Just what the market has been calling for.

PRICE remarkably low.

No. 0 Perfect Hack Saw
Capacity 0″ to 6″ or more on request. Speed 120 R.P.M. Weight 600 lbs.
A perfect machine throughout.



No. 2

No. 2 Perfect Hack Saw
This is a smooth, easy-running machine. You'll find it's worth every dollar you pay for it.
Capacity 5″ x 6″.
Speed 80 R.P.M.

No. 3 Perfect Hack Saw
An ideal, all round Machine Shop Saw, always ready. Automatic shut-off, adjustable arm and screw guide.

Write for complete catalog.



No. 3

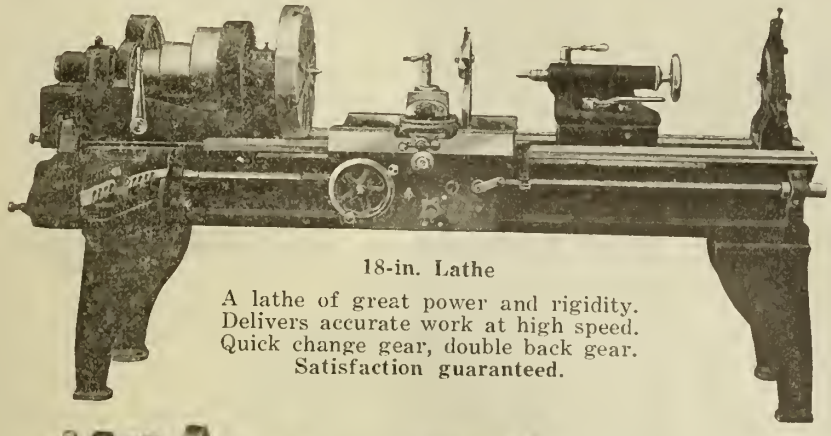
Represented in Great Britain by
Fry's (London) Ltd.

Perfect Machine Co., Limited
Galt, Ontario, Canada

For Sale by The Canadian Fairbanks-Morse Company Limited

FAIRBANKS-MORSE QUALITY F M 100%

PERFECT MACHINES

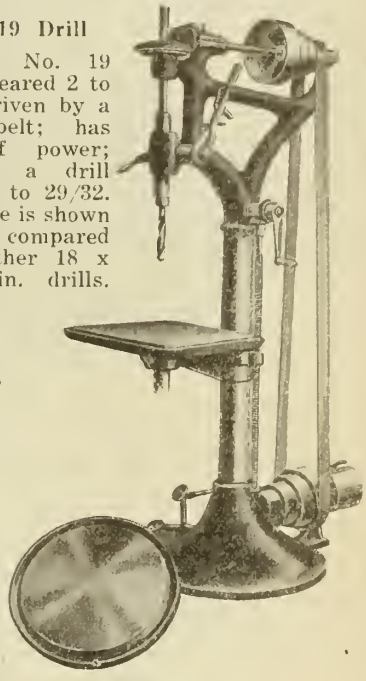


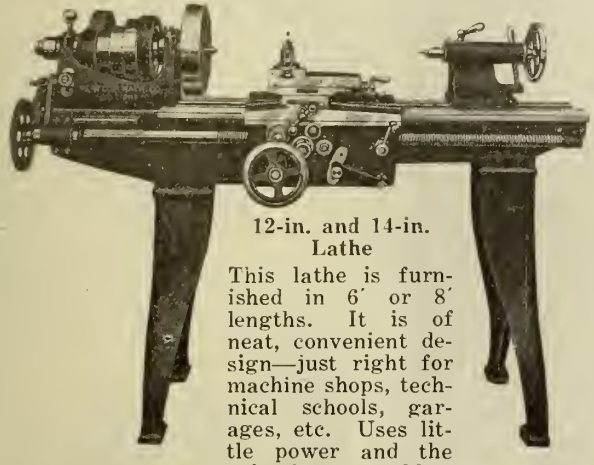
18-in. Lathe

A lathe of great power and rigidity. Delivers accurate work at high speed. Quick change gear, double back gear. **Satisfaction guaranteed.**

No. 19 Drill

Perfect No. 19 Drill, geared 2 to 1, is driven by a 2-in. belt; has lots of power; handles a drill from 0 to 29/32. Its value is shown when compared with other 18 x 20-in. drills.





12-in. and 14-in. Lathe

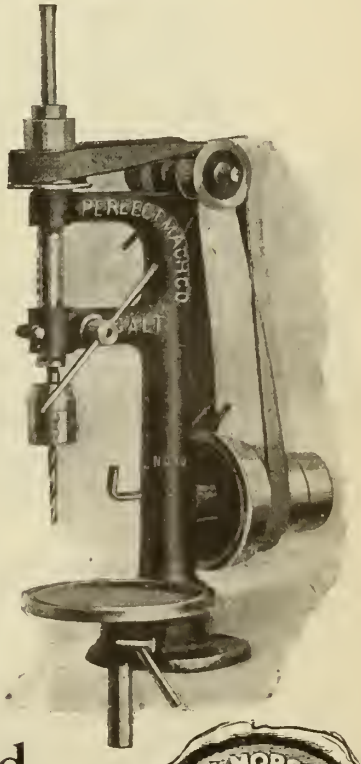
This lathe is furnished in 6′ or 8′ lengths. It is of neat, convenient design—just right for machine shops, technical schools, garages, etc. Uses little power and the price is reasonable.

No. 18 Drill

This drill combines efficiency, accuracy, durability and convenience of operation.

Drills to centre of 10 in. Speed 2,500 R.P.M.

Perfect Grinders have stood the test. Enquire of users for confirmation.





We've just finished a combination surface grinder to take 12″ x 2″ wheel. Table 8″ x 18″ will travel vertically 8″. Table has micrometer adjustment

Ask for descriptive literature and prices.

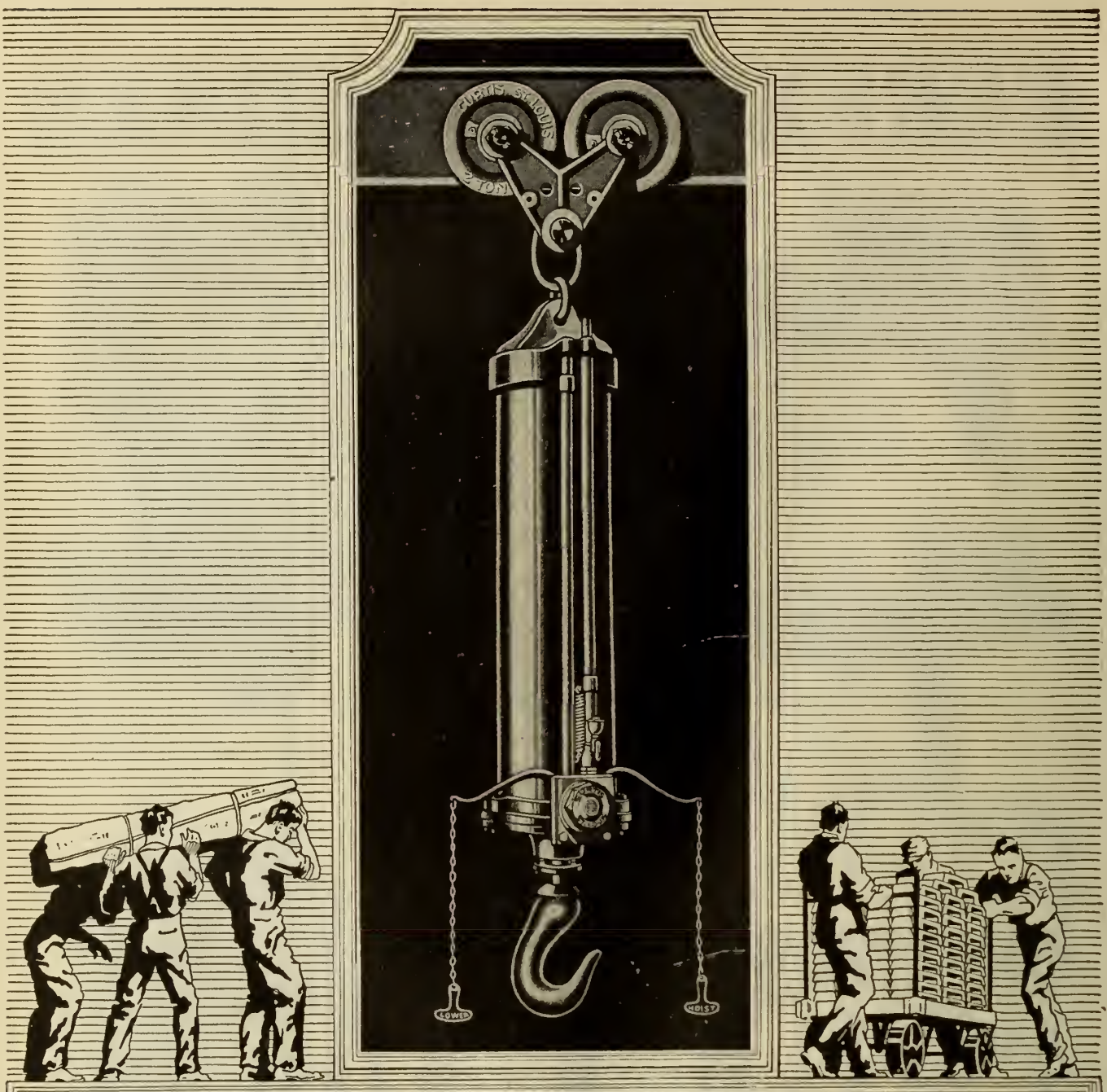
Perfect Machine Co., Limited

Galt, Ontario, Canada

For Sale by The Canadian Fairbanks-Morse Company Limited

FAIRBANKS-MORSE QUALITY F M 100%

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CURTIS AIR HOISTS and TROLLEYS
SAVE MAN-POWER

CURTIS Trolleys are constructed with self-equalizing steel side frames and large inclined wheels fitted with shock-absorbing Hyatt Flexible Roller Bearings—making them easy to start—easy rolling and long lasting.

CURTIS All-Steel Air Hoists, in design and construction, present the perfected results of 25 years of manufacture. They are simple, safe and economical for light and medium loads. Capacities, 800 to 20,000 lbs.

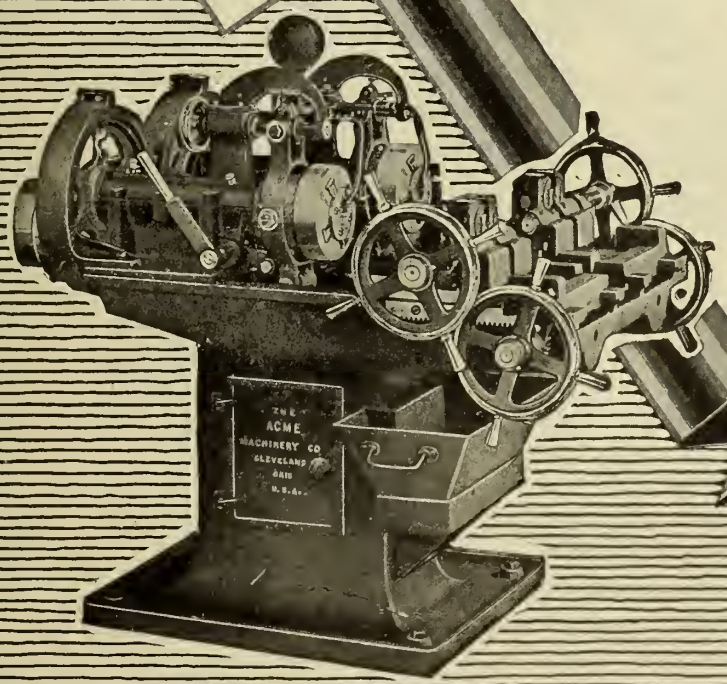
CURTIS PNEUMATIC MACHINERY COMPANY

1637 Kienlen Avenue ST. LOUIS, U. S. A.

Branch Office: 531-S Hudson Terminal, New York City

BOLTS

SQUARE HEXAGON TEE HEAD



Cut Them In Your Own Plant

and Save Money on Cost and Delay in Deliveries

ACME BOLT CUTTERS

are made in various sizes for cutting bolts from ¼ to 1 in. diameter. Their heads allow micrometer adjustments while they are in motion. The dies can be changed from one size to another in less than one minute and produce clean, accurate, highly-finished threads.

May we send catalog?

The Acme Machinery Co.

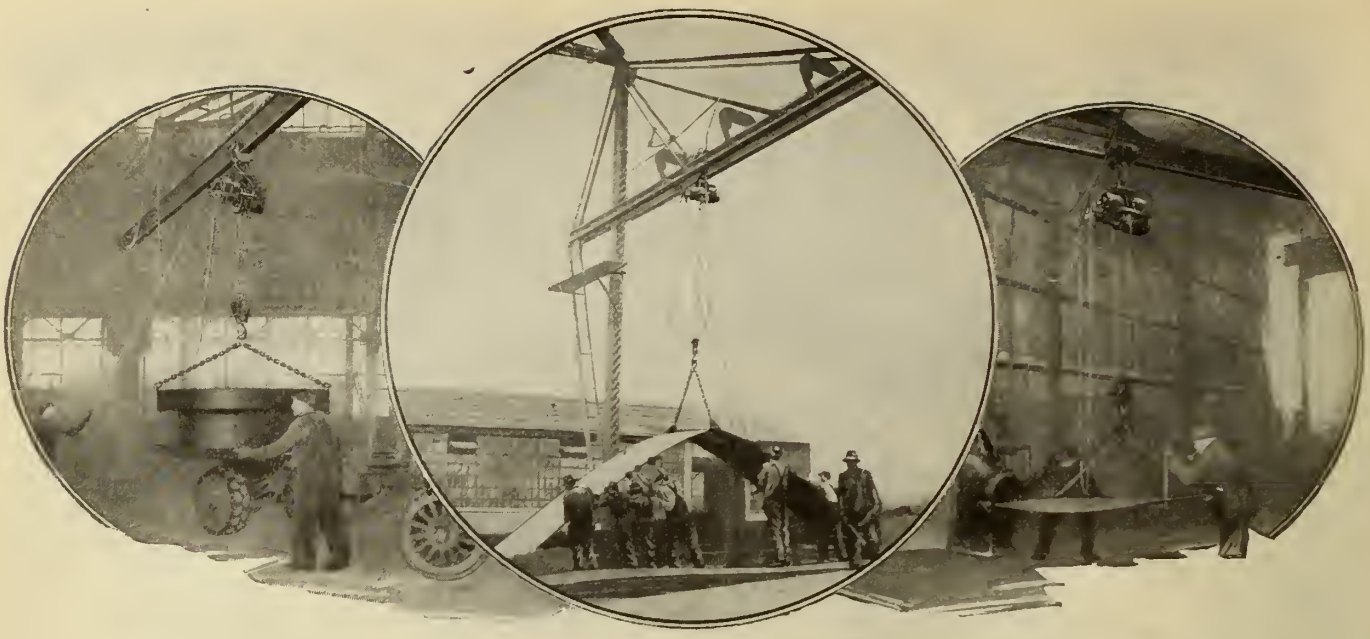
4530 St. Clair Ave. Cleveland, Ohio

We make a complete line of Bolts, Rivet, Heading, Upsetting and Forging Machines, Bolt Cutters, Hot Pressed Nut Machines, Hammer Heads, Bolt Pointers, Nut Tappers.

Representatives for Canada:
The John Bertram & Sons Company, Limited, Dundas, Ont.

ACME BOLT CUTTERS

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If the Pyramids were built today—

PIECE by piece, with years and men no object, clumsy hand-power slowly built the ancient Pyramids.

But, today, when men and minutes count big, man-power stands little chance in a tug-o'-war with the swift lifting power of Little Giant Pneumatic Geared Hoists.

They lift from one to ten tons without a hitch, jerk or jolt. A Little Giant load never slips because its automatic air-brake always grips. It holds what it hoists. A protecting limit-stop prevents jam-ups from over-hoisting.

Hoist pneumatically! Reduced labor costs and increased production prevail wherever Little Giants are used. These rugged all-steel hoists put *lifting* on a *production* basis.

Capacities of from 1 to 10 tons, in stationary, trolley, and geared trolley types. Ask for instructive Pneumatic Tool Bulletins.

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The Holden Company, Limited

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Sales and Service Branches: TORONTO, 342 Adelaide Street, West WINNIPEG, 150 Princess Street VANCOUVER, 81 Pender Street

Canadian Factory: Canadian Pneumatic Tool Company, Montreal

P 89 H

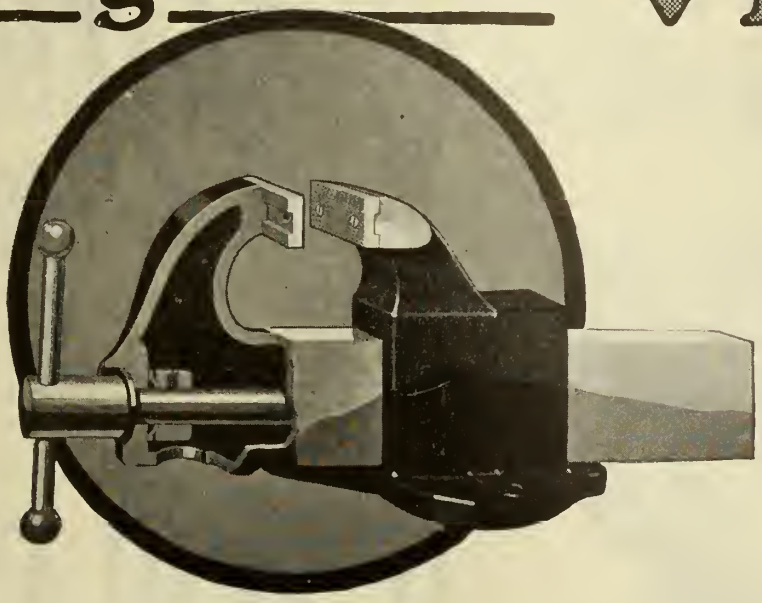
BOYER PNEUMATIC HAMMERS·· LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
CHICAGO PNEUMATIC AIR COMPRESSORS·· VACUUM PUMPS·· PNEUMATIC HOISTS,
GIANT OIL AND GAS ENGINES ROCK DRILLS ·· COAL DRILLS

CANADIAN PNEUMATIC

LITTLE *Pneumatic* **GIANT** *Geared Hoists*

COLUMBIAN

Sledge-Tested VISES



The Hollow Jaw IS Stronger

EVERY mechanic knows that a hollow tube has greater bending strength than a solid bar of the same weight of material. By actual test a tube 5 feet long is about three times as strong as a solid bar of the same weight and length.

Columbian Sledge-Tested Malleable Iron Vises are built according to this widely used principle of mechanics. The hollow jaw construction makes them much stronger than solid vises of the same weight. This construction, as applied to vises, is patented and can be used by no other manufacturer.

Columbian Sledge-Tested Vises are the only vises made of malleable iron. This feature alone makes them twice as strong as cast iron vises. The jaws will not chip, crack or break.

Removable steel jaw faces, cold-rolled steel handle with forged ball ends that never come off, are additional advantages that make Columbian Sledge-Tested Vises standard equipment in many of the largest machine shops in the world. They are a distinct aid to large-scale production.

Columbian Hardware Division

of The Consolidated Iron-Steel Mfg. Co.

World's largest makers of vises and anvils

CLEVELAND

For Sale by The Canadian Fairbanks-Morse Company Limited

FAIRBANKS-MORSE QUALITY F M 100 lb

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The City of *St Johns* Quebec

It Will Pay You to Bring Your Plant to

the City of

St. Johns

QUEBEC

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

Everything Here a Progressive Manufacturer Desires

The City of St. Johns Offers Real Inducements

EXEMPTION of taxes for fifteen years' period, subject to extension; all public improvements required, such as street extensions, sidewalks, waterworks and sewage; five per cent. bonus on your payroll for five years! Such are the inducements offered to you to bring your plant to St. Johns, a city with a promising future in the province of Quebec.

LOCATION St. Johns is on the Richelieu River (27 miles from Montreal), provides the city with a direct water route to the Eastern Seaboard of the United States and the Great Lakes. Its commanding position in relation to the important markets of Canada and the United States assures economy and dispatch in the assembling of raw materials and distribution of the finished product.

POWER A plentiful supply of power is developed at Chambly, eleven miles north-east of the city and distributed in St. Johns at rates that will compete with any city or town in Canada. Excellent railway connections assure a satisfactory coal supply.

SHIPPING Seven railroads, including Canada's two great transcontinental lines, run through the city. St. Johns obtains lower freight rates than any other centrally-located point on the continent.

LABOR St. Johns is known as the cheapest labour market in Canada. Skilled and unskilled labour is always plentiful and labour troubles are unknown.

In addition to the natural advantages of St. Johns as a location for a new industry, the city greatly reduces the initial expense and difficulties of organization by granting many extraordinary inducements and concessions.

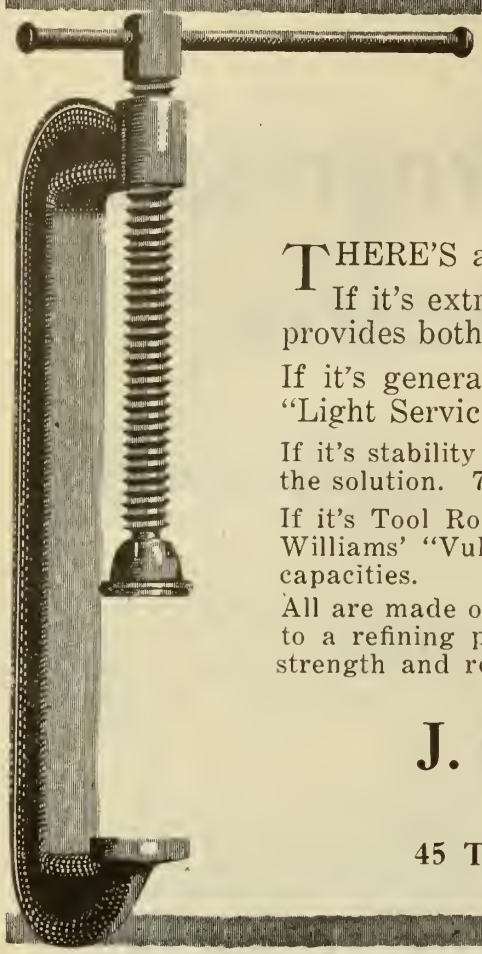
Facts About St. Johns You Should Keep Before You

—Seven railroads, including Canada's great transcontinental lines.
—Finest ocean shipping facilities.
—Canal connections with New York, the Eastern States and the Great Lakes.
—Cheapest labor market in Canada.
—Plentiful supply of skilled and unskilled labor.
—Cheap and abundant electric power.
—Cheap coal and lower freight rates.
—Desirable factory sites with tax privileges.

For Full Information Write to

The Secretary of the City Council
ST. JOHNS, QUEBEC, CAN.

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WILLIAMS' SUPERIOR DROP-FORGED CLAMPS

THERE'S a Williams' Clamp for every purpose.

If it's extreme strength and heavy service—Williams' "Vulcan" line provides both. 11 sizes, ¾ to 12½ inches capacities.

If it's general utility—without need for maximum strength—Williams' "Light Service" line will fit the case, 8 sizes, 2 to 12 inches capacities.

If it's stability and utility—medium service—Williams' "Agrippa" line offers the solution. 7 sizes, 4 to 18 inches capacities.

If it's Tool Room work requiring comparatively small openings of jaws — Williams' "Vulcan" Tool Makers' line should be chosen. 4 sizes, 1 to 4 inches capacities.

All are made of a special, high-grade steel. After forging they are subjected to a refining process, or heat treatment, which increases their stiffness and strength and reduces the liability of springing.

MACHINISTS' TOOLS BOOK ON REQUEST

J. H. Williams & Co., Ltd.

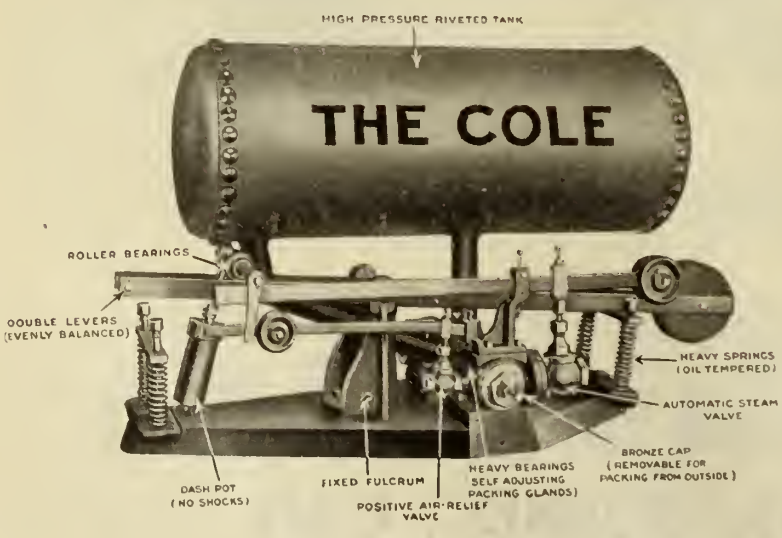
"The Drop-Forging People"

Formerly Canadian Division of The Whitman & Barnes Mfg. Co.

45 Thorold Road, ST. CATHARINES, ONTARIO

The "COLE" For COAL ECONOMY

The "COLE" Trap has self-adjusting packing glands, operating on Roller bearings, on a fixed fulcrum which permits of full discharge at each operation.



The Return Trap will receive water from Lifting or Non-Return Trap, or High or Low pressure and return back and into boiler.

The Lifting Trap will receive water from any pressure and discharge to Return Trap.

The Non-Return Trap will hold back the steam and discharge the water into any receptacle with lower pressure than coil to be drained. It has a valve opening as large as the pipe connection and will cause no more friction than 20 ft. of pipe.

Full information on request.

GEO. W. COLE LIMITED

2002 Dundas St. W., TORONTO, Canada

Geo. A. Young, 203 Scott Block, WINNIPEG, MAN.

510 Coristine Bldg., MONTREAL, QUE.

Robt. Hamilton & Co., VANCOUVER, B.C.

SPECIAL MACHINERY

LET US BE YOUR TOOL ROOM

BROWN ENGINEERING SERVICE means up-to-the-minute equipment and highly skilled workmen, which enables us to build high quality and long service into all the special machinery and tools we make.

We have one of the best equipped plants in Canada with superior quality machine tools of every description, including a complete line of millers, grinding machinery, Johansson blocks, etc.

Send us your blue prints for estimates when you require any kind of special machinery, gauges, punches, jigs, dies, precision tools, etc.

MADE IN BR·EN·CO CANADA

Brown Engineering Corporation
LIMITED, TORONTO
415-419 King St., W. Tel. Adel. 425

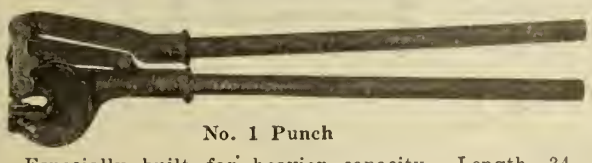
Whitney Portable Hand Metal Punches

Allow Work to be Done Anywhere

These Whitney Metal Punches are not necessarily bench tools. Being convenient in size, they make powerful Hand Punches, allowing work to be done anywhere, with or without a vise.

Made of the best material—Drop Forged parts. Punches and dies quickly changed. No tools needed to dissemble; no bolts to remove, as in other makes.

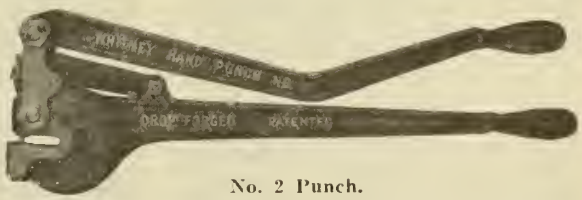
W. A. WHITNEY MFG. CO.
715 PARK AVE., ROCKFORD, ILL.
Prices and full particulars upon request.



No. 1 Punch

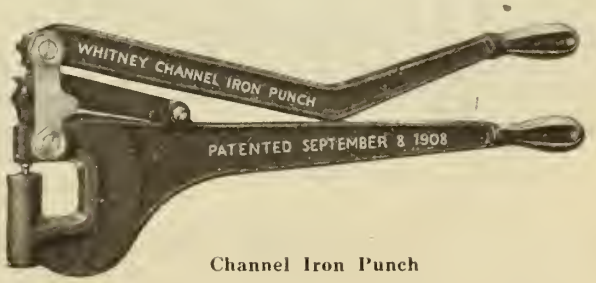
Especially built for heavier capacity. Length, 34 inches. Weight, 22 pounds, well distributed, to nicely balance the tool. Capacity, ⅜-inch hole through ¼-inch iron.

Always specify SIZES of Punches and Dies desired when ordering.



No. 2 Punch.

Length, 23 inches. Weight, 14 pounds. Capacity, 5-16-inch hole through ¼-inch iron, or equivalent. Punches and dies in 13 sizes—⅛ to ½-inch by 1-32-inch.



Channel Iron Punch

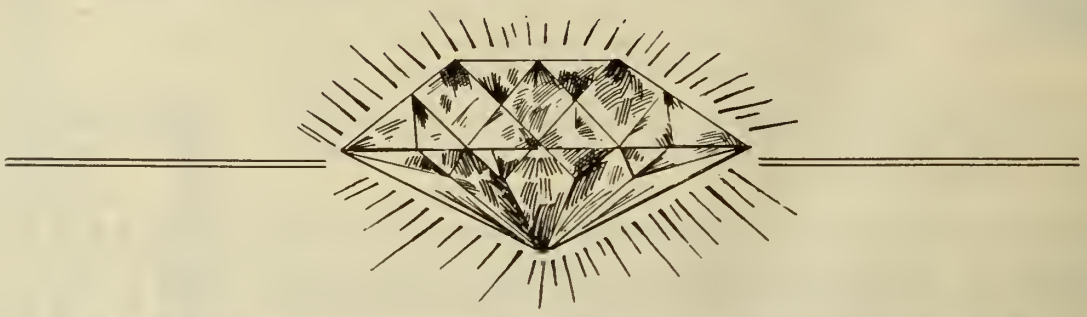
A companion to No. 2 Punch. Every part of the two tools interchangeable. Length, 23 inches. Weight, 16½ pounds. Capacity, ¼-inch hole through ¼-inch iron, or equivalent.

Canadian Agents:—Canadian Fairbanks-Morse Co.; A. R. Williams Machinery Co.; Williams & Wilson; McClary Mfg. Co.; H. W. Petrie, Ltd.

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-BORTZ-
DIAMONDS
-CARBON-

DIAMOND POINTED TOOLS





Brown & Sharpe

WE are direct importers of Industrial Diamonds.

Importing in large quantities, carrying a large stock on hand at all times, we can furnish you promptly any size, character or quality of Rough diamond you may desire at a price that is right.

Special care is observed in selecting stones of a size and shape, suitable for your particular work.

We also specialize in mounting diamonds, manufacture diamond pointed tools for every industrial purpose. Our Copper, Brass and Cast Steel mountings are guaranteed.

Our many years of experience have proved to our customers that co-operation with our Service Department saves them money. Have our Salesman call upon you and explain our Service feature.

A Postal card will bring him.

WHEEL TRUEING TOOL CO.

Importers of Bortz and Carbon Diamonds

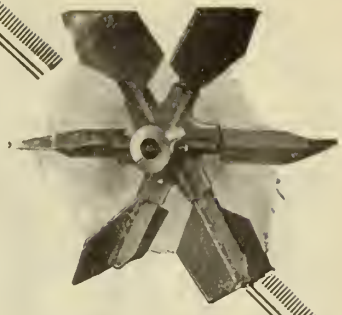
General Offices and Works :

2130 Penobscot Building - DETROIT

Branches :

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120 Wisconsin St., Milwaukee, Wis.
88 West Pitt St., Windsor, Ont.
7 James St., St. Catharines, Ont.

Keep Your Shop Clean



Remove your sawdust, shavings, or other loose material with a

Canadian Standard Reversible Mill Exhauster

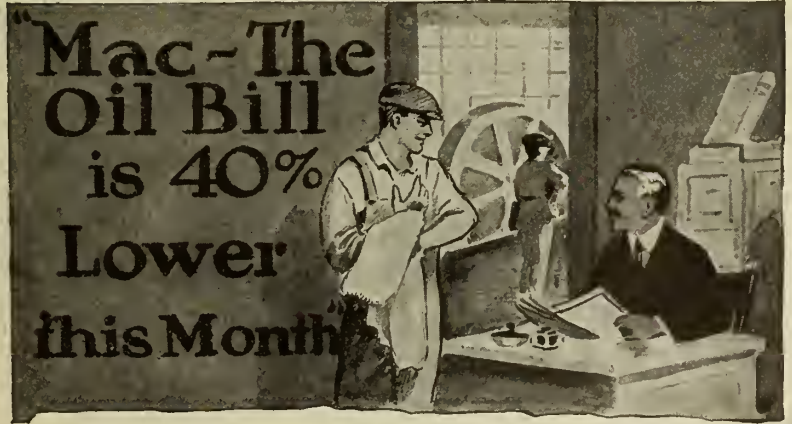


A clean shop with machines free from shavings, chips, or sawdust makes for greater efficiency.

Let our engineering department help you plan your refuse exhauster system.

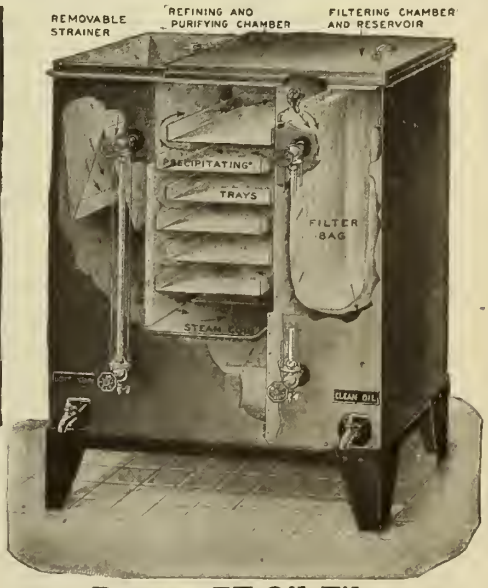
Write for Catalogue 16.

Canadian Blower and Forge Co., Limited
KITCHENER, ONT.
Toronto Montreal Calgary Vancouver St. John



"Yes, sir, and there's a good reason for it too. Since we installed the BOWSER Oil Filtering Outfit the men in the engine room have been competing to see who could save the most oil. They've cleaned the journal boxes, put pans under them to catch the drips and then put the salvage through the BOWSER Oil Filtering Outfit. We are now using the oil over and over again that was formerly wasted."

The BOWSER Oil Filtering Outfit is simple, compact, economical and reliable.



Bowser 7F Oil Filter

First, means a cleaner engine room.

Second, it cuts your lubricating oil bill considerably.

Third, IT PAYS FOR ITSELF over and over.

WRITE FOR LITERATURE DESCRIBING OIL FILTERING SYSTEMS SUITABLE FOR YOUR POWER PLANT.

LONDON
32 Victoria St., S. W. 1
HAVANA
Lonja del Comercio 427

S. F. BOWSER CO., Limited
66-68 Fraser Avenue, TORONTO, ONT.

PARIS
5 Rue Denis-Poissons
SYDNEY
6 Castlereagh St.

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The City of Sarnia

Locate Your Factory Here!

Eight Good Reasons!

1. It has the best of lake shipping facilities.
2. Its railway connections are unexcelled anywhere.
3. It is close to the big manufacturing States of the Middle West, Michigan, Ohio, Illinois, etc.
4. Its location makes it a central distributing point for the trade of the entire Dominion.
5. Abundant electric power is available at reasonable rates.
6. Plenty of skilled and unskilled labor are obtainable.
7. It offers the best of manufacturing sites with both rail and water shipping facilities.
8. Liberal concessions in tax exemptions, street extensions, etc., can be obtained.

THESE FACTS ARE WORTHY OF THE SERIOUS CONSIDERATION OF EVERY MANUFACTURER. WRITE NOW, FOR MORE DETAILED INFORMATION, TO

W. J. I. PARSONS, Chairman, Industrial Committee, Sarnia
J. M. McADAM, Secretary, Chamber of Commerce, Sarnia

The Map Shows This Ideal Site



POWER APPARATUS

Of Established Reputation and Dependability

Weston Indicating Instruments

SANGAMO Integrating Instruments

ESTERLINE Graphic Instruments

ONDIT Oil Switches and Circuit Breakers

All above are standard equipment on our Power Switchboards.

CANADIAN CROCKER-WHEELER Induction Motors and Transformers A. C. Generators, D. C. Motors and Generators

CUTLER-HAMMER Control Apparatus, Magnetic Clutches, Lifting Magnets

Wagner, Quality Single Phase Motors

All distributed by

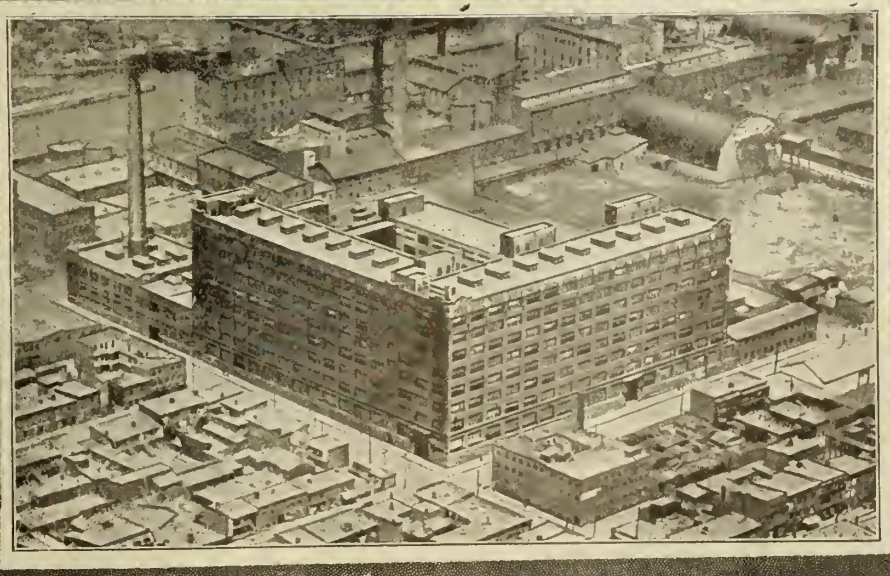
Northern Electric Company

LIMITED

MONTREAL

HALIFAX TORONTO
QUEBEC LONDON
OTTAWA HAMILTON

WINDSOR CALGARY
WINNIPEG EDMONTON
REGINA VANCOUVER



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"Stubby"

A New Type Bridge Reamer

"Stubby" is about 25 per cent. shorter than the regular length bridge reamer, and the taper of the flutes is considerably sharper.

This results in a stronger, cheaper reamer which will materially lower reaming costs.

A "Stubby" reamer in the chuck of an air or electric drill is more easily handled—awkwardness of finding the hole and getting to work is done away with. "Stubby" Reamers will ream out a hole in little more than half the time required by the old-type bridge reamer.

All "Imco" Tools are good tools — built to remove more metal in less time; to be more accurate; to last longer between grindings; to have longer life!

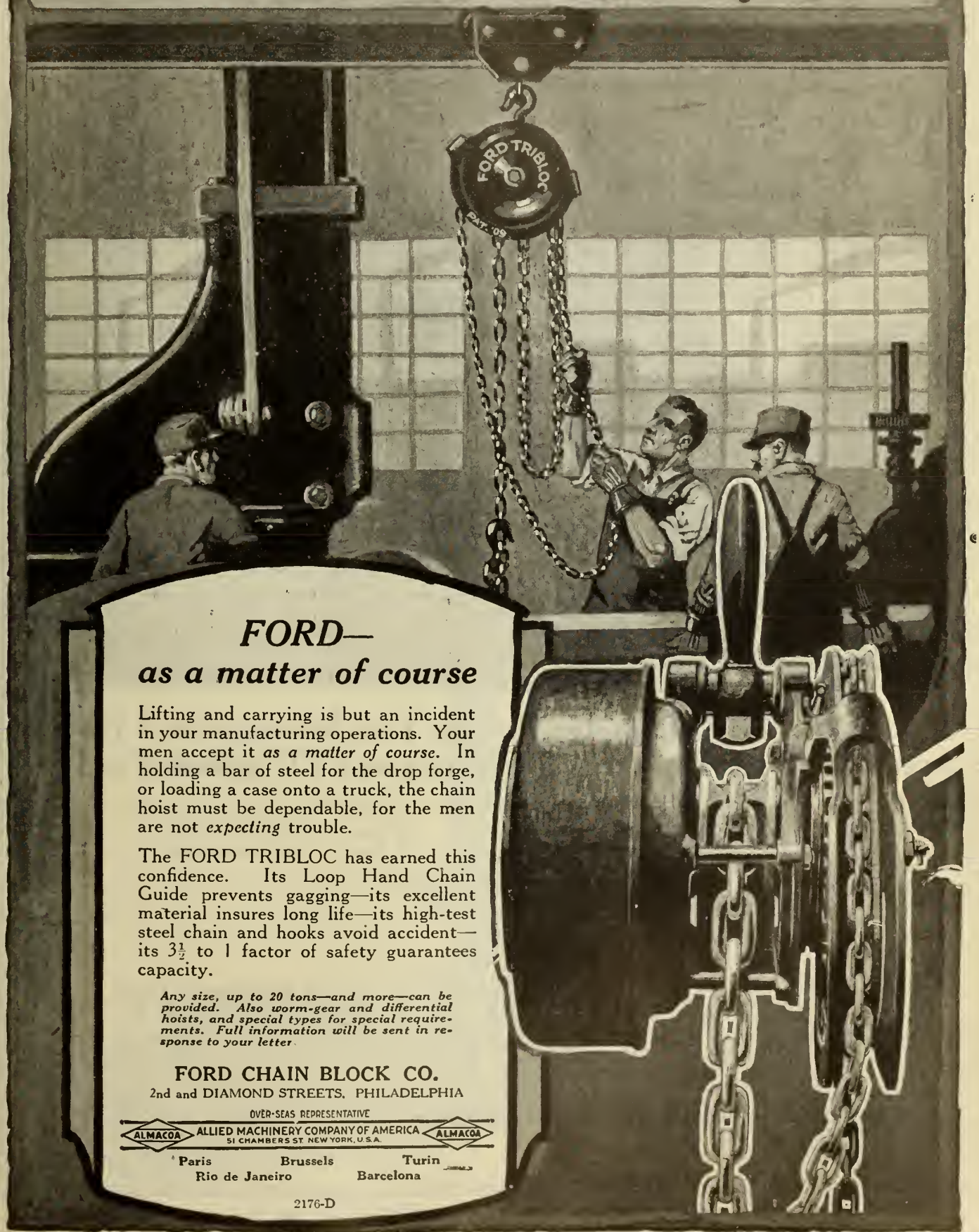
Catalog of "Imco" 3 and 4-lip drills, reamers and milling cutters upon request.

Ingersoll Machine & Tool Company, Limited

INGERSOLL - ONTARIO

Toronto Branch: 80 Bay St., Phone Adelaide 7227
Chas. A. Strelinger Co., Ltd., Windsor, Ont.

FORD TRIBLOC



FORD—
as a matter of course

Lifting and carrying is but an incident in your manufacturing operations. Your men accept it *as a matter of course.* In holding a bar of steel for the drop forge, or loading a case onto a truck, the chain hoist must be dependable, for the men are not *expecting* trouble.

The FORD TRIBLOC has earned this confidence. Its Loop Hand Chain Guide prevents gagging—its excellent material insures long life—its high-test steel chain and hooks avoid accident—its $3\frac{1}{2}$ to 1 factor of safety guarantees capacity.

Any size, up to 20 tons—and more—can be provided. Also worm-gear and differential hoists, and special types for special requirements. Full information will be sent in response to your letter.

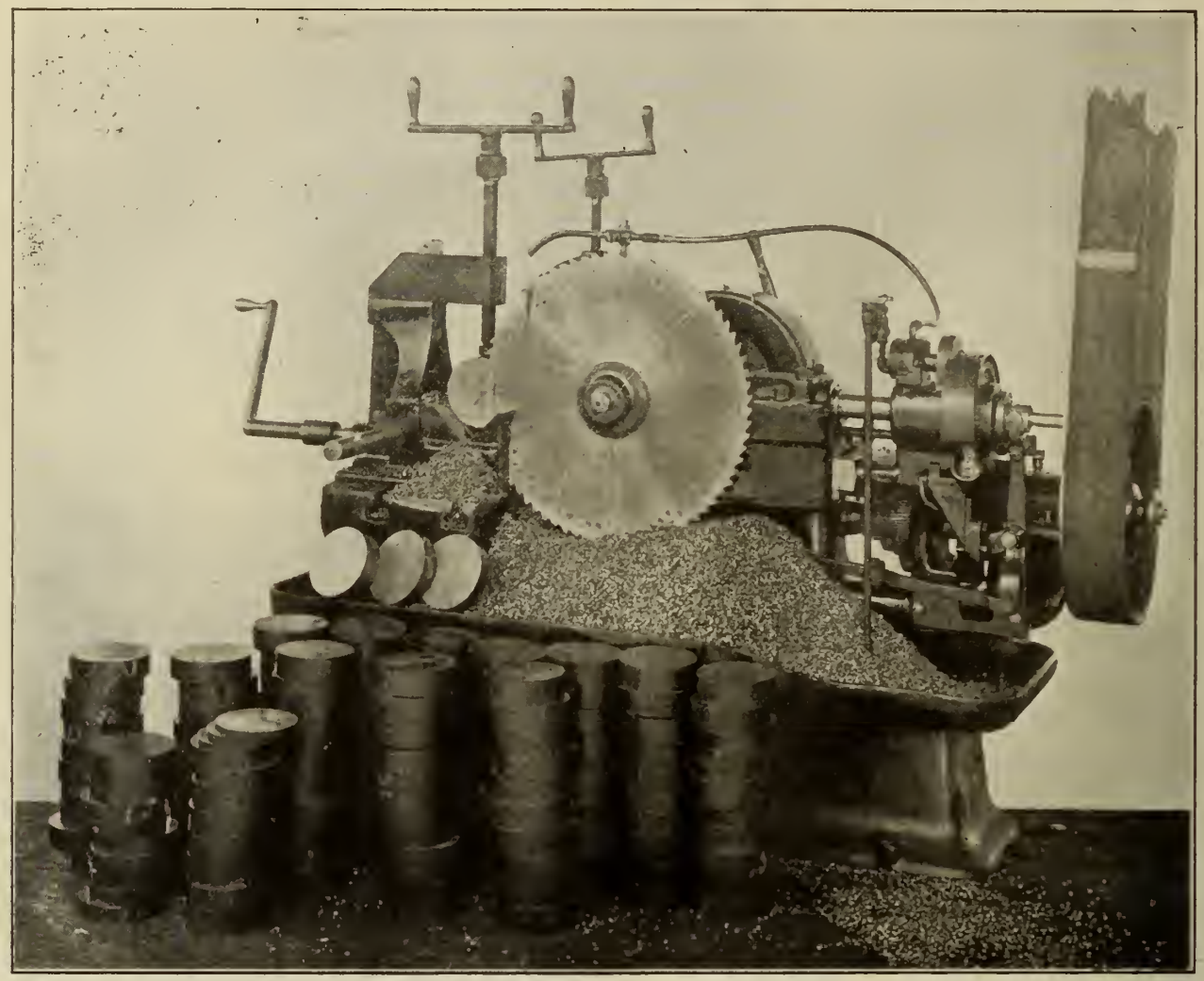
FORD CHAIN BLOCK CO.
2nd and DIAMOND STREETS, PHILADELPHIA

OVER-SEAS REPRESENTATIVE
ALMACOA ALLIED MACHINERY COMPANY OF AMERICA ALMACOA
51 CHAMBERS ST. NEW YORK, U.S.A.

Paris Brussels Turin
Rio de Janeiro Barcelona

2176-D

COCHRANE-BLY No. 5 COLD SAW



144 Pieces 5¼" Diameter Cut on This Machine in 8 Hours
Actual Cutting Time was 3 Minutes and 10 Seconds Per Cut

Will Also Cut in Multiple at One Time:

76 Bars ½ in. Diameter
26 Bars 1 in. Diameter
13 Bars 1½ in. Diameter
8 Bars 2 in. Diameter
4 Bars 2½ in. Diameter

We build five sizes of these machines, and also an Automatic Saw Sharpening machine.

Catalogue on request

COCHRANE-BLY COMPANY

ROCHESTER, N.Y.

Agents for Canada—

A. R. Williams Machinery Co., Limited

Toronto Montreal Winnipeg Vancouver

Handles at One Setting Pieces Too Long or Too Bulky for Usual Type of Machine

Double setting of work not only wastes time but is a frequent cause of error when boring holes for shafts or bearings which must be exactly parallel.

"MILWAUKEE"

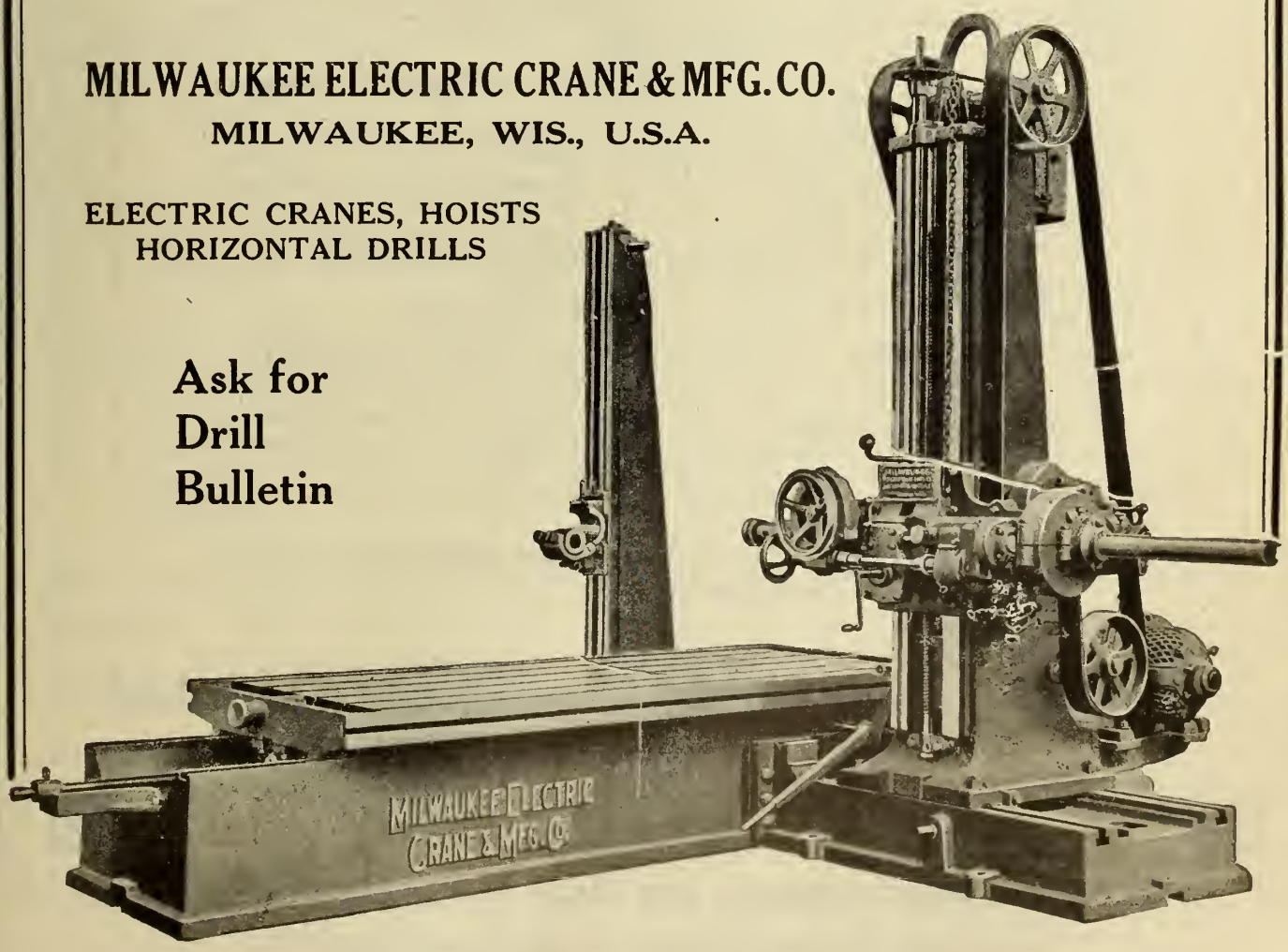
Horizontal Drilling & Boring Machine

speeds up work in the shop by saving time and simplifying operations.

MILWAUKEE ELECTRIC CRANE & MFG. CO.
MILWAUKEE, WIS., U.S.A.

ELECTRIC CRANES, HOISTS
HORIZONTAL DRILLS

Ask for Drill Bulletin



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OILGAS
INDUSTRIAL FURNACES

Lower Fuel Bills *for* The New Year

THAT'S the **Oilgas** New Year's Greeting—one of vital importance to you.

Resolve now to put your heating system on a more profitable basis. Industrial Furnaces burning **Oilgas** will cut your fuel bills in half. They are more economical than coal, producer gas, or powdered fuel.

Furnaces for

Continuous Forging
Continuous Reheating
Annealing, Hardening
Billet Heating
Enamelling
Heat Treating
Malleable Melting
Rivet Heating
Plate and Angle Heating

Typical Users

Canadian Pacific Railway Co.,
Canadian National Railways,
Canadian Steel Foundries,
Canadian Tube & Iron Co.,
Baldwin's Canadian Steel Corpn.,
Dominion Foundries and Steel Ltd.,
Crane Co., Ltd.,
B. J. Coghlin Co., Limited,
Verity Plow Co., Limited,
Canada Grip Nut Co., Ltd.,
Steel Co. of Canada, Ltd.,
Dominion Copper Products Co.

Oilgas Industrial Furnaces are the most modern, efficient and economical heating method—full details on request.

General Combustion Co. of Canada Limited

619-623 New Birks Building, MONTREAL

"Experts in the Economical Combustion of Liquid Fuels"

Oilgas Furnaces Are Made in Canada

STEEL & IRON PRODUCTS

Quality Service

OF EVERY DESCRIPTION

HAMILTON PIG IRON
Basic Malleable Foundry

STEEL AND IRON BARS

OPEN HEARTH STEEL SHEETS

RAILROAD TRACK MATERIAL
Angle Bars Track Bolts Tie Plates Tie Rods Spikes

SCREWS	WIRE	NAILS
Steel	Steel and Brass, Copper and	Wire
Brass	Bronze, Heavy and Fine,	Cut
Bronze	Bright, Annealed, Coppered,	Boat
Wood and	Galvanized, Tinned, Stranded,	Horseshoe
Machine	Steel and Copper Cable,	Shoe Nails
Screws	Barb, Woven Clothes Line	Tacks

POLE LINE HARDWARE
Pole Steps Cross Arm Braces Guy Clamps Guy Rods

WROUGHT PIPE	FORGINGS	LEAD PRODUCTS
Black Pipe	Car Axles	Lead Pipe
Galvanized Pipe	Shape and Drop Forgings	White Lead
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BLOOMS
BILLETS
PLOW BEAMS
ANGLES
CHANNELS

THE
STEEL COMPANY
OF
CANADA
LIMITED
HAMILTON MONTREAL

WIRE RODS
HORSE SHOES
FENCING
RIVETS
BURRS

If interested tear out this page and place with letters to be answered.

HAMILTON
Quality Equipment and Service

The results of the experience gained from seventy years specializing in high grade, dependable Saw Mill, Pulp Mill and Hydraulic Turbine Machinery are apparent in all William Hamilton products. Our experience, our facilities and the service which go with all our products make us an exceedingly favorable firm to deal with. Try us and see!

Hydraulic Power Plant Equipment

Water Wheels
Water Wheel Governors
Head Gate Hoists
Stop Log Winches
Trash Racks
Butterfly Valves
Power Transmissions
Hand Power Travelling Cranes
Steel Feeder Pipes
Surge Tanks

Pulp Mill Equipment

Log Haul-ups
Pulp Wood Slashers
Pulp Wood Conveyors
Barking Drums
Centrifugal Pump Screens (horizontal and vertical)
Beating Engines
Flat Screens
Pulp Grinders
Centrifugal Pumps
Triplex Stuff Pumps
Slusher Tanks
Chippers
Chip Crushers
Jordon Engines
Chip Screens (rotary and flat)
Digester Fittings
Push Pans
Agitator Drives
Refuse Burners
Transmission Machinery
Steel Plate Work

Saw Mill Equipment

Boom Chains
Warping Anchors
Capstans for Warping
Log Jacks
Log Jack Equipment
Band Mills
Log Carriages
Set Works (steam and hand)
Edgers
Husk Frames
Live Rolls and Drives
Slashers
Trimmers
Cut-Off Saws
Lath Mill Machinery
Shingle Mill Machinery
Filing Room Machinery
Resaws (circular)
Hogs
Drag Saws
Gang Circulars
Twin Circulars
Steam Feeds
Friction Feeds
Transmission Machinery
Haul-up and Transfer Chains
Refuse Burners
Conveyors
Engines (slide and piston valve)
Boilers
Feed Water Heaters

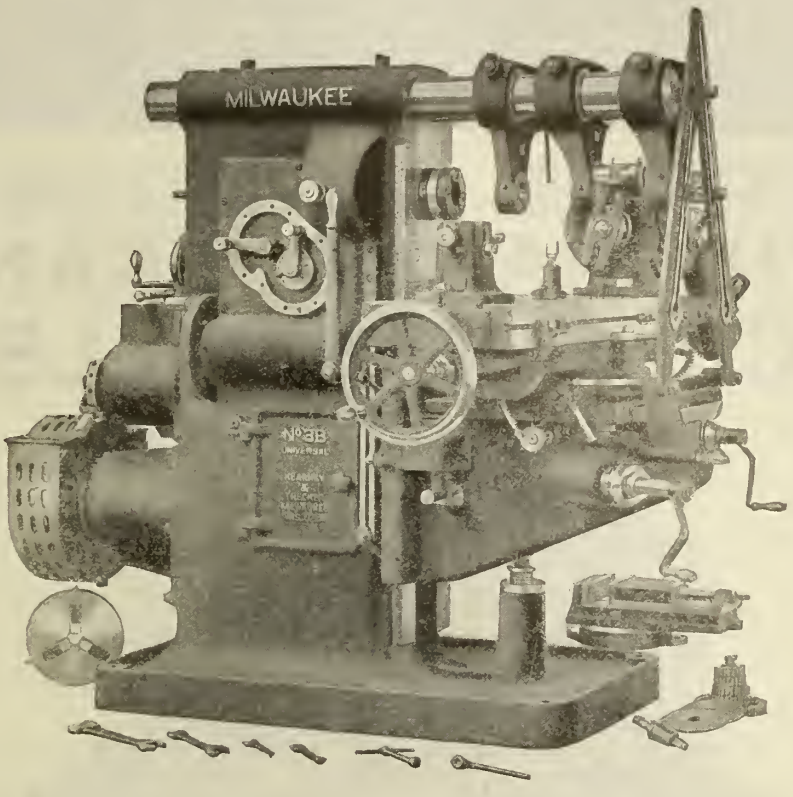
General Equipment

Gray Iron Castings
Brass Castings
Special Machines Built to Order
Patterns
Transmission Machinery
Steel Plate Work
Tanks
Standpipes
Structural Steel Work
Smoke Stacks
Boiler Breechings
Steel Pipe
Steel Bins and Hoppers

Send us your specifications

WILLIAM HAMILTON COMPANY
LIMITED
PETERBOROUGH, CANADA

Milwaukee Universal Milling Machines



Superior Service in the Tool-Room

Milwaukee Universal Milling Machines are accurate, rigid and flexible, and are distinguished for their efficiency on all kinds of milling done in the tool-room. Light or heavy operations are as one to the "Milwaukee."

A really scientific construction with all parts of the machine properly proportioned so as to form practically a single unit; features to reduce supervision, maximize ease of operation and increase the accuracy, rigidity and entire efficiency of the machines, make Milwaukee Universal Milling Machines the choice for the tool-room.

Firms that seek the certainty of tool-room satisfaction under all conditions find their hopes realized in the "Milwaukee."

Our catalogue No. 22 will be gladly sent to you on request.

KEARNEY & TRECKER CO. MILWAUKEE, WIS., U.S.A.

Canadian Representatives:

Williams & Wilson, Ltd., Montreal — F. F. Barber Machy. Co., Toronto — A. R. Williams Machy. Co., Vancouver and Winnipeg.

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CANADA
FOUNDRIES & FORGINGS
LIMITED

ENDURANCE BRAND CRUSHER BALLS



SIZES—2", 3", 3½", 4", 4½", 5", 6", 6½"

OUR GUARANTEE:

The exclusive use of flawless steel, tested and approved.

The methodical and purposeful application of combined expert knowledge in the Forge.

The scientific employment of latest methods of heat treatment of steel.

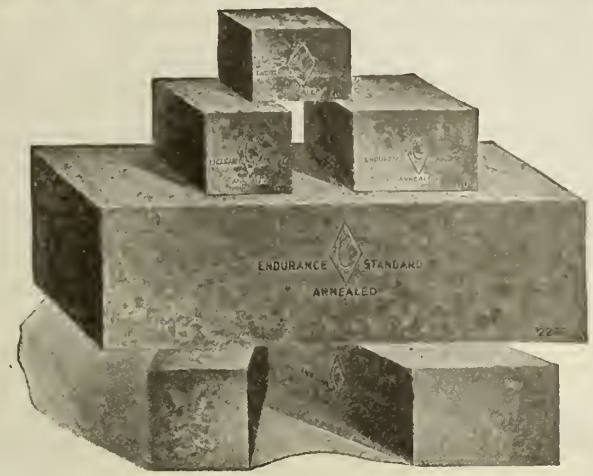
The unerring fulfillment of the requirements entrusted to us by our friends.

CANADA FORGE PLANT, Welland, Canada

NOTHING BUT FORGINGS

CANADA
FOUNDRIES & FORGINGS
LIMITED

NI-KROM DIE BLOCKS



GRADE—This is our first grade block hard and tough and recommended for long runs of forgings.

DESCRIPTION—NI-KROM Die Blocks are forged from an alloy steel having both Nickel and Chrome content.

IDENTITY—On two sides of these blocks will be found this symbol:

NI-KROM ◇C◇ Annealed

WARRANTY—These NI-KROM Blocks are warranted against flaws, pipes, seams and forging defects. Where impressions must maintain exact dimensions, and long runs are desired, this block is recommended for both duration and economy. This block must be hardened before using in a hammer.

HEAT TREATMENT

If so ordered WE will give this NI-KROM Block expert heat treatment which will increase the hardness quality by about One Hundred per cent. over the annealed block. This quality of hardness will be equal throughout the entire block and will make it more difficult for the Die Sinker to work, but as soon as the impression is sunk the Blocks are ready for immediate use in the hammers without any other treatment. Impressions may be renewed and immediately used again without annealing or further heat treatment.

IDENTITY—When these Blocks are heat treated in our plant before shipment, on two sides will be found this symbol:

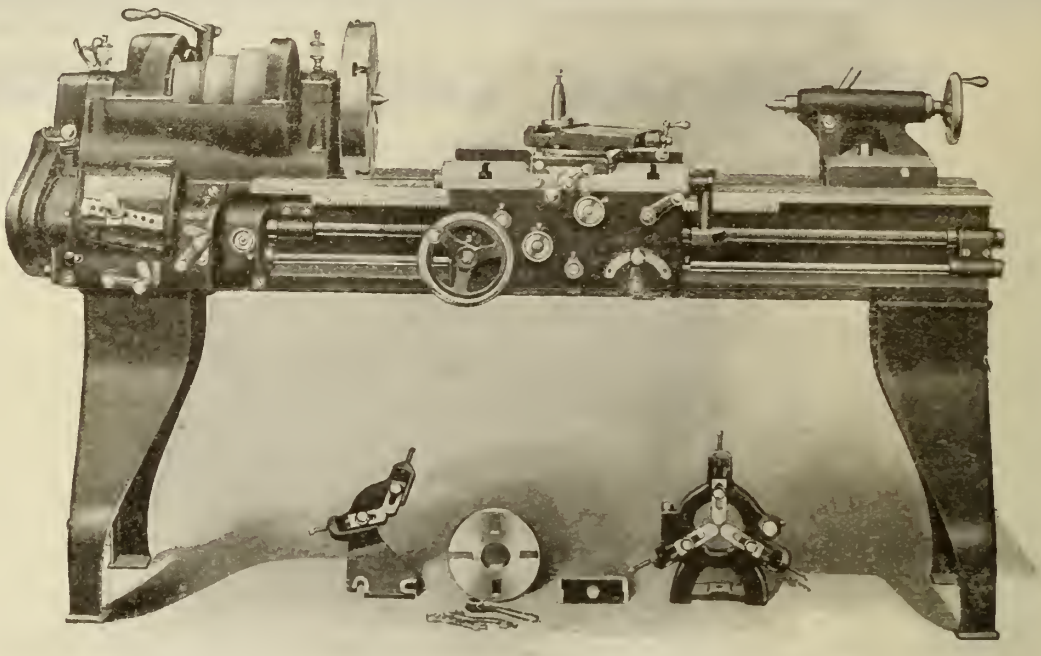
NI-KROM ◇C◇ Treated

Extra Charge is made for this service.

CANADA FORGE PLANT, Welland, Canada

NOTHING BUT FORGINGS

The "ECONOMY"



"ECONOMY" 14-inch Swing, Double Back Geared Quick Change Engine Lathe

THE "ECONOMY" 14-inch Engine Lathe is especially designed to meet the demands for a small, heavy-duty machine of sufficient weight and power to handle the rapid production of the modern manufacturing plant. Being high grade and extremely accurate, it is a suitable machine for the tool room, and also general repair and garage work.

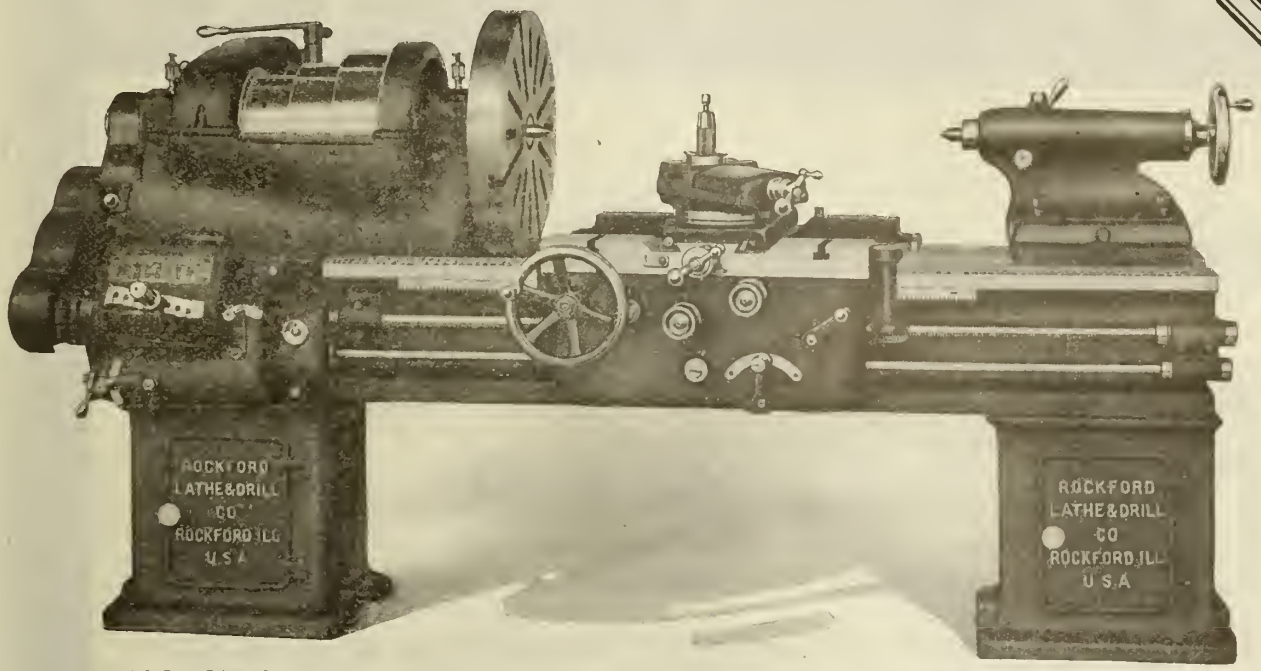
The headstock is massive and firmly bolted to the bed and has a three-step cone of large diameter for a 2½" belt. The double back gears are conveniently shifted from the front and are provided with a safety device which makes it impossible to lock the gears or strip the teeth. The bearings are exceptionally large, of a special composition metal, and are carefully machined and hand-scraped to fit spindle. The spindle is of high carbon steel, accurately ground, and has a 1 5-16" hole its entire length, and is provided with special thrust bearing of alternate collars of hardened steel and bronze. The double friction, self-oiling countershaft has pulleys 10" diameter with 3½" face.

"Economy" Lathes are also built in 12", 18" and 22" swing sizes. Our catalog explains the four sizes and also the various attachments in detail. Shall we send you a copy?

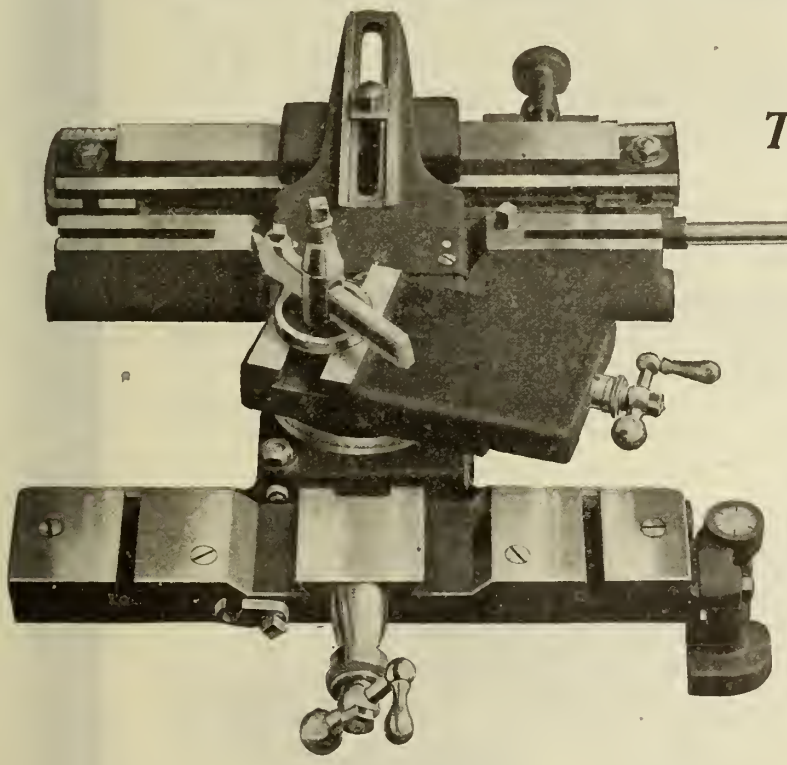
Rockford Lathe

Builders of Engine Lathes

Rockford,



"ECONOMY" 22-inch Swing, Double Back Geared Quick Change Engine Lathe



Taper Attachment

ON the left is illustrated the taper attachment as furnished for our 12", 14" and 18" lathes. Its design is simple and consists of very few parts and its construction is extremely sturdy. No special bed is required; as all carriages are drilled, this attachment may be applied at any time. It is permanently fastened to the back of the carriage, making it instantly available at any position on the bed.

The regular compound rest and cross slide are used. The extra extension required is furnished with attachment and is interchangeable with short one supplied with regular lathe equipment.

& Drill Company

Illinois, U.S.A.

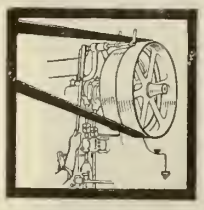
Builders of Engine Lathes

BELTING

For Transmission

SCANDINAVIA BELTING — FEDERAL ENGINEERING & SUPPLIES LIMITED — TORONTO

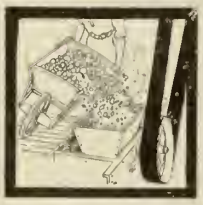
For Conveying



GOOD ON BELT SHIFTERS



GOOD IN OILY PLACES



GOOD IN DUSTY PLACES



GOOD IN HOT PLACES

For Conveying

Use the regular Scandinavia Belt for conveying abrasive materials such as coal, rock, ore, coke, etc., and you will be surprised at the material it can handle per dollar cost.

For non-abrasive material use our special conveyor. This is especially adapted for handling clay, pulp, sawdust, sand, etc.

And the price is very reasonable.

For Transmission

The illustrations to the left indicate where this belt can be used to advantage. This belt makes a good general service belt except for driving in cold temperatures.



Write Us Your Requirements

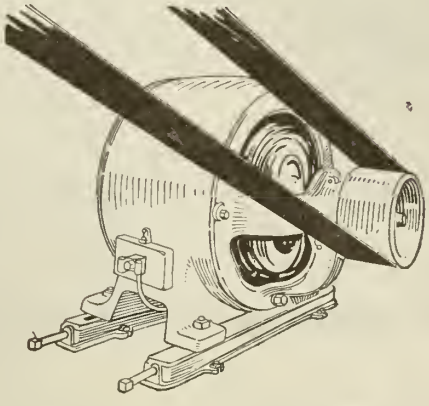
FEDERAL ENGINEERING CO., LIMITED

172 John St., Toronto

BELTING

Lanco Balata Belts
For Transmission

They Last Longer

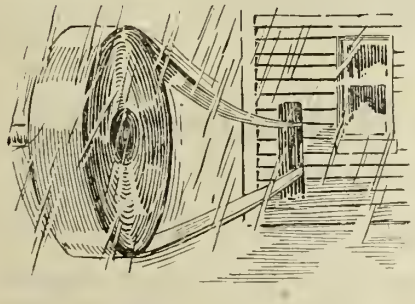


It's all in the Quality

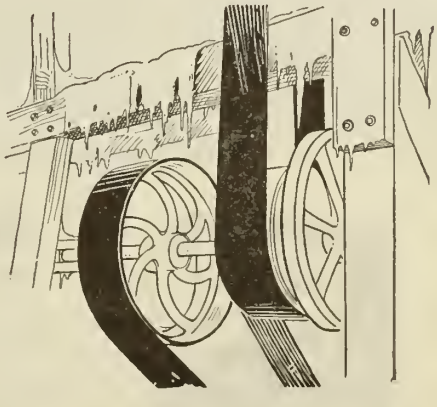
The high quality of **Lanco Balata** is a well-established fact. This belting is strong, pliable, really waterproof, and is in good condition long after an ordinary belt is worn out.

From the standpoint of economy

You will find that no other belting will give the same long service in so many ways as **Lanco Balata.**



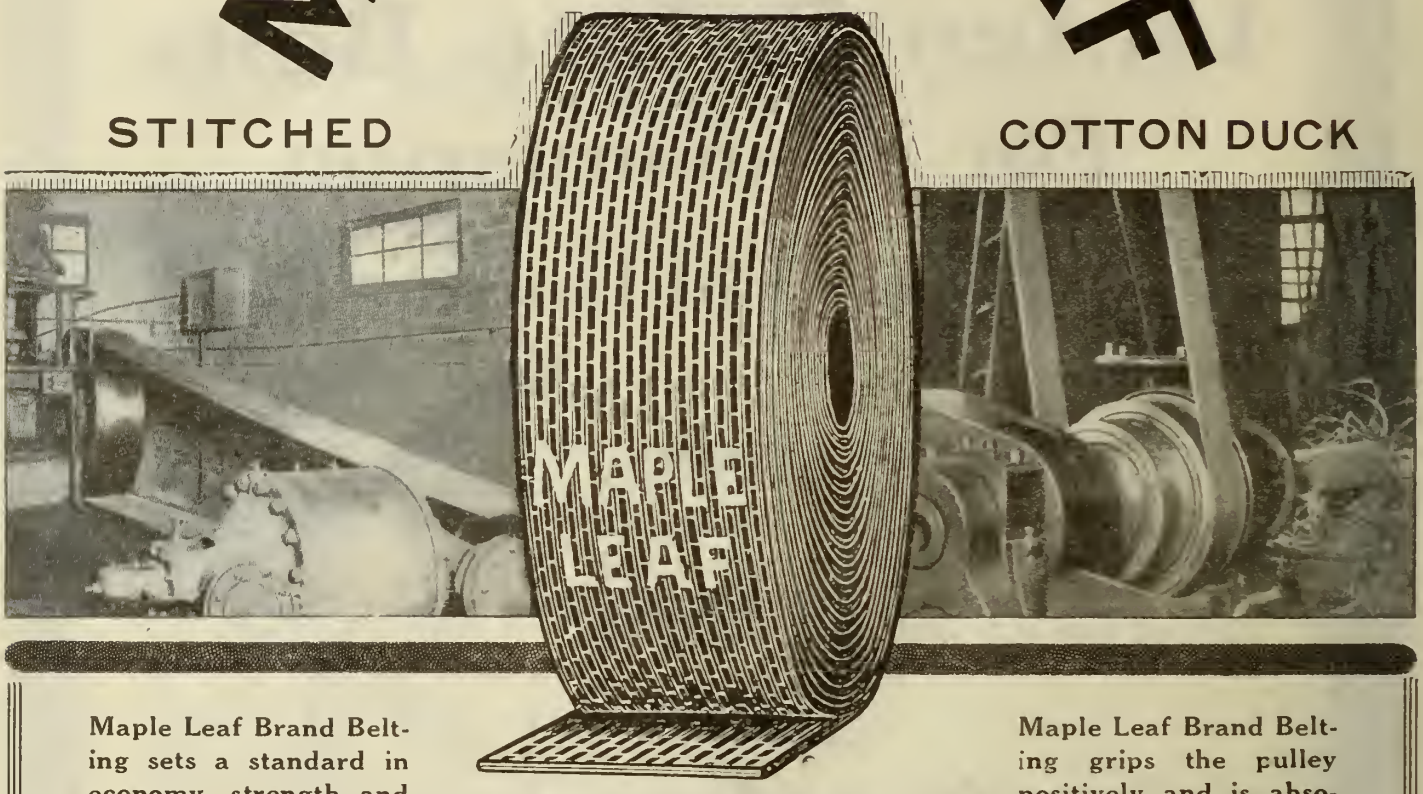
TRADE MARK
LANCO BALATA
BELTING



FEDERAL ENGINEERING CO., LIMITED
172 John St., Toronto

MAPLE LEAF BRAND

STITCHED COTTON DUCK



Maple Leaf Brand Belting sets a standard in economy, strength and durability.

Maple Leaf Brand Belting grips the pulley positively and is absolutely true running.

BELTING

For transmission of power or conveying purposes Maple Leaf Brand Belting is as efficient as any belting you can buy. It costs less than leather, rubber or balata. Figured on a basis of "service per dollar" it is the best belting buy on the market. Satisfied users throughout Canada will verify these statements.

A recent test at a Canadian university proved that Maple Leaf Brand Belting will stand a breaking strain 50% greater than leather and 25% greater than rubber.

We will gladly send samples and price list on request.



Maple Leaf Belt Dressing

BEST FOR ALL KINDS OF BELTS

Maple Leaf Belt Dressing does not contain resin, mineral or animal oils or other ingredients harmful to belts.

All belts should have an occasional application of a reliable dressing in order that the best results be obtained. We recommend Maple Leaf Belt Dressing as the safe and sane treatment.

Dominion Belting Co., Ltd.

HAMILTON, CANADA

Quebec Branch--51 Duluth Building, Montreal

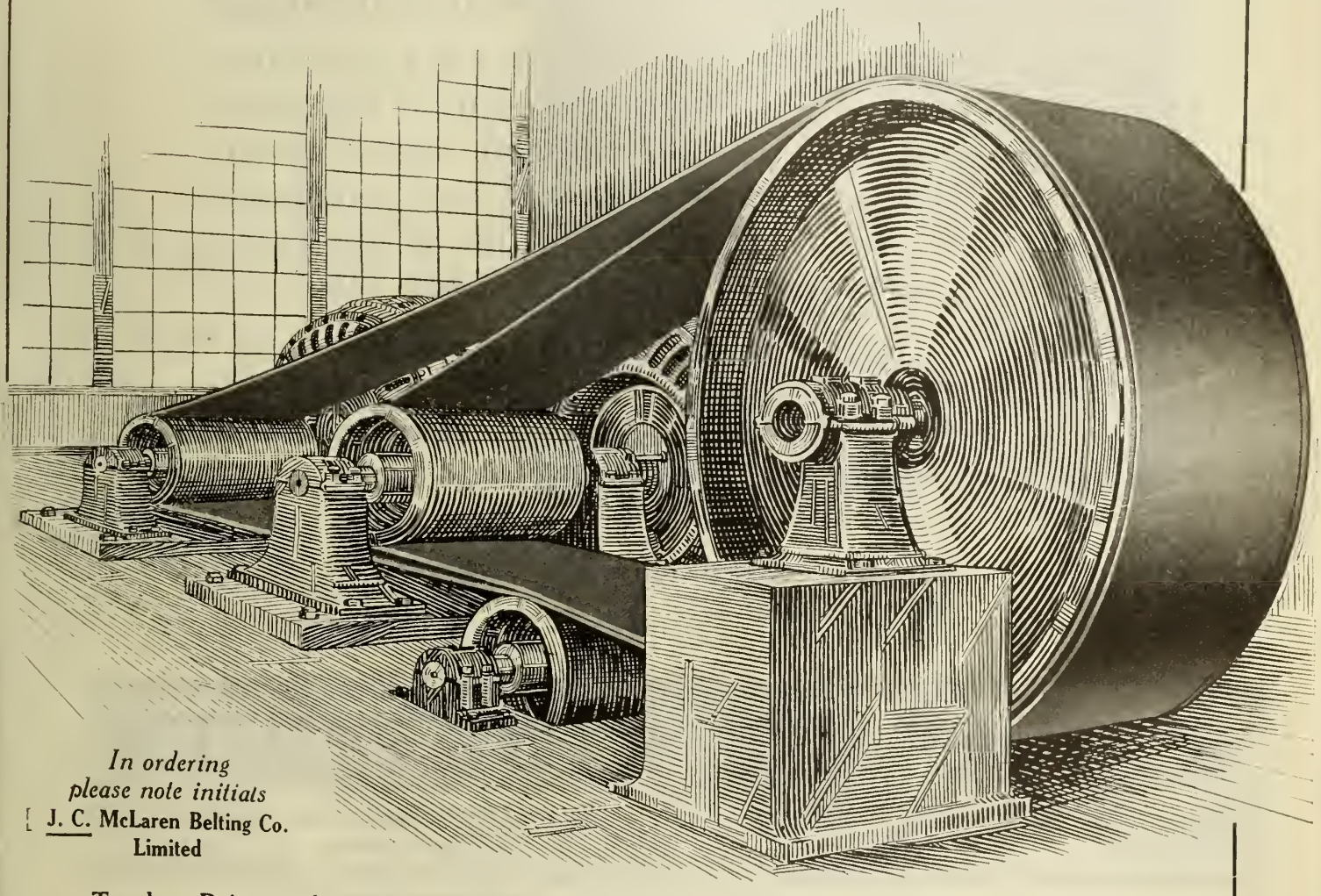
Established 1856

The J. C. McLaren Belting Co., Limited

Manufacturers of

The Belt that puts the Pull in Pulley

Card Clothing, Hydraulic Washers and Dealers in General Mill Supplies



In ordering please note initials J. C. McLaren Belting Co. Limited

Tandem Drive at the Royal Mills, Montreal, which is satisfactorily transmitting 900 H.P.

FOR 65 years we have manufactured *the best leather* belts for all purposes, including PEERLESS PLAINER BELTS for small diameter pulleys at high speed. VIKING WATERPROOF BELTS for laundries and all wet places, etc. When ordering, please specify what belts are to be used for.

You Get the Best by Ordering From

J. C. McLAREN BELTING CO., LIMITED

Head Office and Factory: MONTREAL. Branches: Toronto, Winnipeg, Calgary

If interested tear out this page and place with letters to be answered.

Power is Expensive—SAVE IT

But not by reducing production.

In fact, by the use of ball bearings, you can largely increase production and consume no more power than formerly, for in the average plant friction destroys at least 25 per cent. of all the power produced or bought.

High grade ball bearings, such as S K F and Hess-Bright, are almost frictionless. Not only is less power required, but belting life is lengthened, wear is practically eliminated, bearing renewals are postponed almost indefinitely, frequent tying up of equipment is avoided, oil costs are lower, and hot boxes are unknown.

Ball bearings, by conserving the energy formerly wasted, benefit the whole power line from the machines back to the boilers.

Canadian SKF Company Limited

Montreal Toronto

SKF INDUSTRIES

Hess-Bright Ball Bearings
S K F Ball Bearings
Atlas Steel Balls
Gronkvist Chucks
Transmission Hangers

A Service that contemplates more than the sale of a bearing.

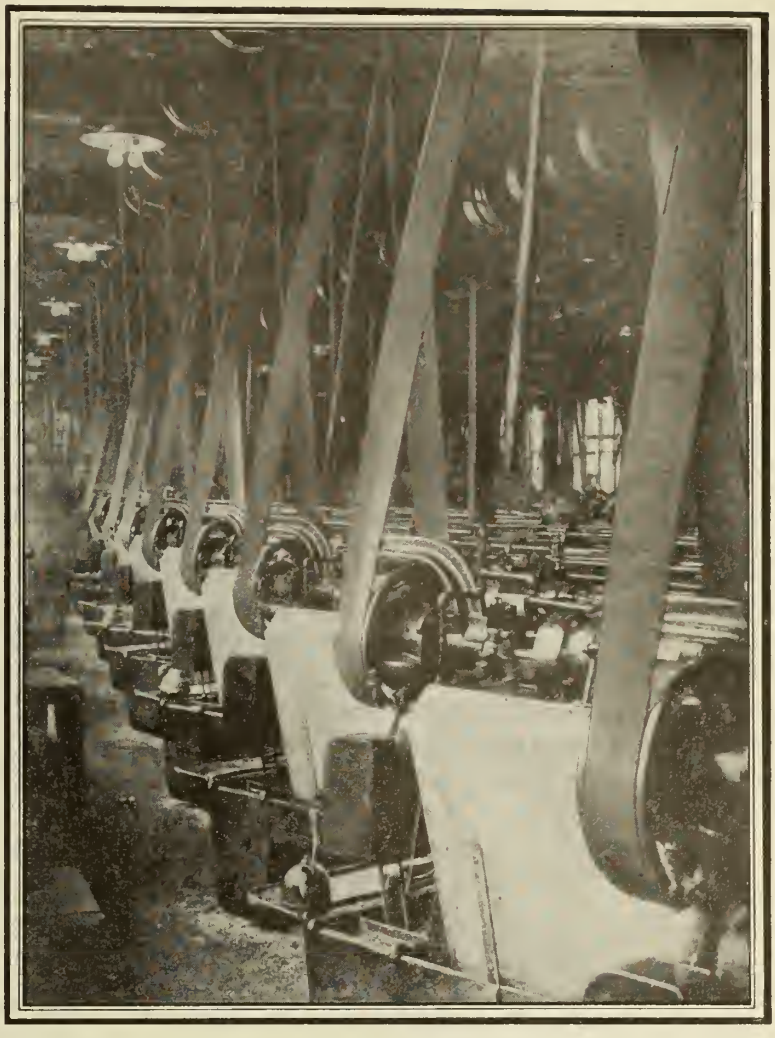
Every S K F Industries service-salesman is a plant engineer equipped to consult on your bearing problems. S K F Service made available through these men is built on a laboratory-backed ideal that seeks to increase Canadian output by lifting the friction load from industrial machinery.

Manufacturers are invited to avail themselves of this freely offered co-operation.



The SKF Research Laboratories where friction problems are solved

An installation of automatic screw machines in a large machine shop—Equipped with G & K belts



This trademark is the symbol of the scientific control of tanning and manufacturing processes and the application of the correct belt for every drive in every industry.

"Aw, you can't scare me"

"BRING on your deep cuts, your oil and cutting fluids, shift me frequently, you can't scare me or stop me," says the sturdy G & K belt.

"I'll pull your machine right through peak loads without a bit of chatter or slowing up, whether it's an automatic screw machine, a grinder, planer, miller or what not. No difference to me! Just watch me turn out the work!

"You fellows who have had belts that slipped and slowed down the machine so that you had to back up and start over, or take a shallower bite—you are the boys who can appreciate me.

"I do the work right because I was built especially for the job by G & K engineers who knew what I'd run into after they had said good-bye to me.

"Those engineers have prepared a book, 101F, that specifies the correct belt for every drive in the machine shop and gives a lot of handy 'dope' on belting. Better write 'em for it—they'll be glad to send a copy free."

CANADIAN GRATON & KNIGHT, LIMITED
84 St. Antoine St., Montreal, Canada
Oak Leather Tanners, Makers of Belts and Other Leather Products
Branches and Distributors in All Principal Cities
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THE CANADIAN FAIRBANKS - MORSE CO., LIMITED

GRATON & KNIGHT

Standardized Series

LEATHER BELTING

Tanned by us for belting use

FAIRBANKS-MORSE QUALITY F M 100%

For Sale by The Canadian Fairbanks-Morse Company Limited

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Buy Belting to Fit the *Work*

THE sure way to buy belts is by giving a belting expert *all* the particulars of the drive.

The size of pulleys, speed and load are not the only factors in belt application.

Goodyear manufactures different types of belts for different uses. And Goodyear trains men to apply these belts to particular drives.

Goodyear Blue Streak is particularly adapted for abnormal conditions—big drives—heavy loads—short centres—intermittent loads.

Goodyear Klingtite fits general needs—the medium drives. Fully 80 per cent of drives can be successfully belted with Klingtite.

Goodyear Glide is probably the belt we will recommend for exceptionally fast drives on small pulleys.

But there is a tremendous number of combinations of speed, load, size of pulleys, atmospheric conditions, which affect not only the type of belt, but also the size.

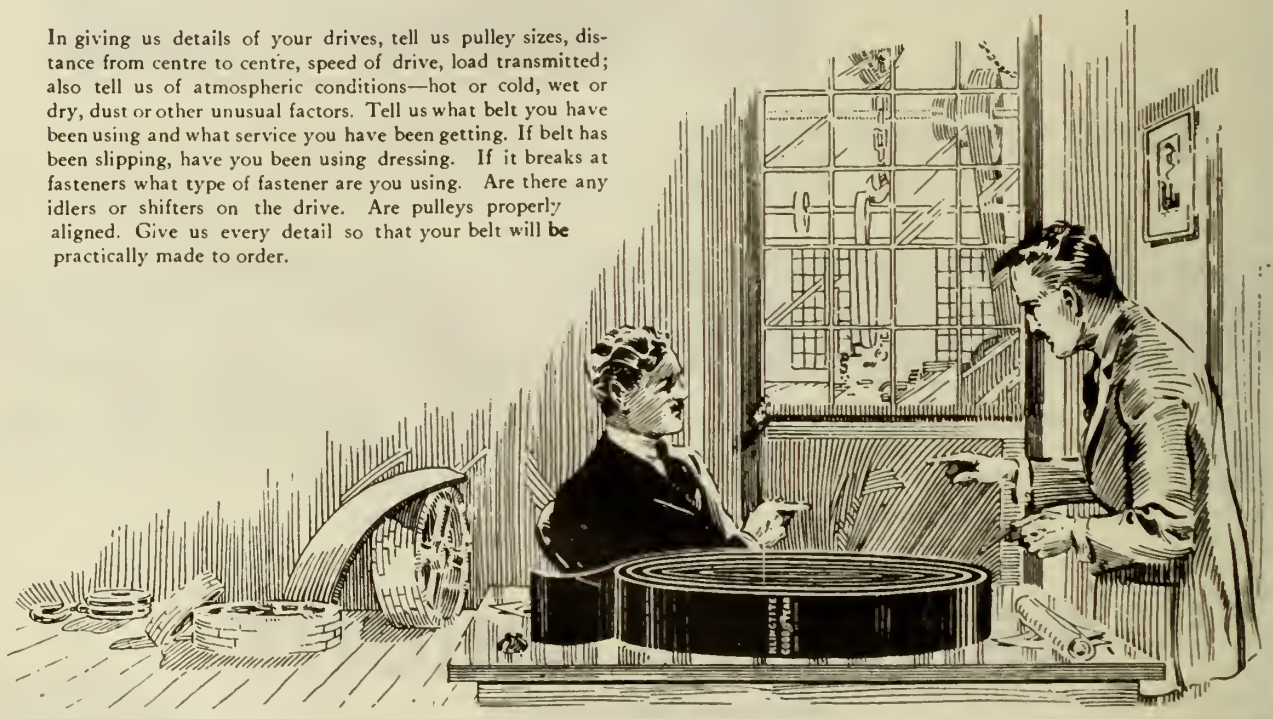
Certain qualities, however, these belts have in common. All are of special Goodyear construction, which resists ply separation and opening at the seam; makes belts flexible and pulley-hugging without sacrificing strength. All have the Goodyear friction surface which offsets slipping. All have a world-wide reputation for trouble-free, economical service.

When you order a belt you need not order by name or size. Send the particulars of the drive to our belting department or give them to a Goodyear belting man. Our recommendation can then be scientific. You do not obligate yourself in any way by getting our recommendation. Just phone, wire, or write the nearest branch.

The Goodyear Tire & Rubber Co. of Canada, Limited

Branches: Halifax, St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, London, Winnipeg, Saskatoon, Regina, Calgary, Edmonton, Vancouver Service stocks in smaller cities.

In giving us details of your drives, tell us pulley sizes, distance from centre to centre, speed of drive, load transmitted; also tell us of atmospheric conditions—hot or cold, wet or dry, dust or other unusual factors. Tell us what belt you have been using and what service you have been getting. If belt has been slipping, have you been using dressing. If it breaks at fasteners what type of fastener are you using. Are there any idlers or shifters on the drive. Are pulleys properly aligned. Give us every detail so that your belt will be practically made to order.



GOODYEAR BELTS

MADE IN CANADA

KLINGTITE GLIDE BLUE-STREAK

FACTORY, FOUNDRY MILL AND MINE

All have their transmission problems to overcome. In many cases the belting used is of an inferior grade, or is not suited to the working conditions. This results in loss of power and general waste. To plant superintendents and engineers we recommend "P.M.S." Belting for use wherever conditions of heat, dampness or mechanical awkwardness makes transmission difficult. Consult our experts: they are at your service.

"P.M.S." BELTING

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GALVANIZED SHEETS IN STOCK

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USED BY ALL MANUFACTURERS

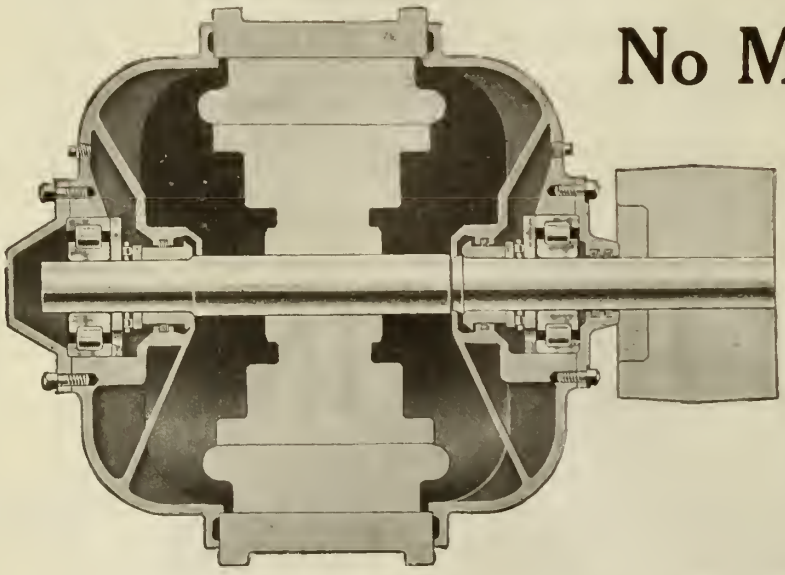
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If an old style plain bearing goes dry you know what inevitably happens. The losses in time and money due to bearing troubles stop when you install

Rollway Heavy Duty Bearings

Even if your motor attendant fails to oil up, the ROLLWAYS do not fail but keep the motor going just the same.

It's that dependability of service under neglect or even abuse that counts. ROLLWAY BEARINGS stay on the job whether looked after or not and the greater the service demand on your motors the more you need ROLLWAYS.

Every motor from 5-hp. up should be equipped with ROLLWAY HEAVY DUTY BEARINGS for your own protection.

Would a 60-day trial on your hardest worked motor with guaranteed results, interest you?

Think that over—and write for data—NOW

RAILWAY ROLLER BEARING CO., Syracuse, N.Y.

WHEN THINKING
OF BELTING
KEEP IN MIND THAT

The back of the OX



is the part where the fibre of the hide is tightest and unaffected by the action of breathing, therefore the most suitable to produce a dead straight and practically stretchless belt.

Tullis
LEATHER BELTING
COLUMBIA BRAND

is made entirely from this portion of the hide.

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SUNCLO is the registered trade mark of the wiping cloths produced by THE LEVI'S.

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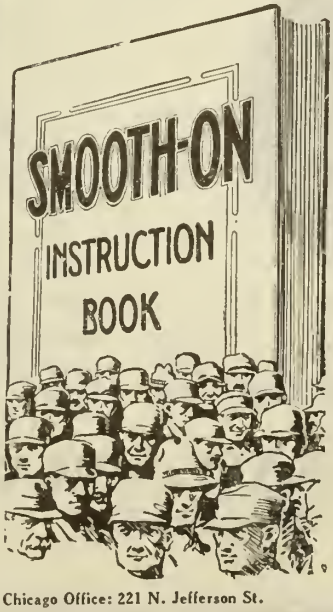
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What Other Engineers KNOW About Repair Work, This Free Book Tells YOU

It is full from cover to cover of practical ideas developed to meet actual emergencies. There is no theory in the

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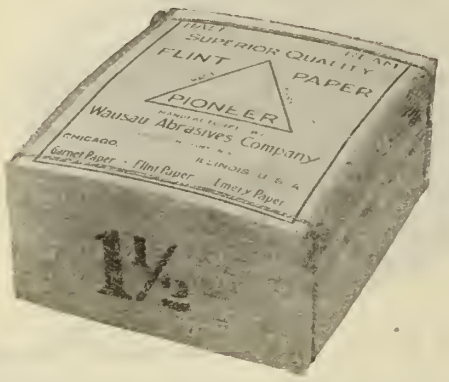
Its 144 pages of **real facts**—facts that—if you knew them—might save you hours—or days and dollars in your next repair job.

Write for it to-day—
It's FREE

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Abrasive Cloth

Indispensable in every metal working shop



"Chief Ruff Stuff"

"Wausite" is a product of the electric furnace. It is recommended as the hardest and sharpest abrasive ever produced. Adapted to finishing all metals, including the hardest alloy steels.

"Wausite" Cloth. Far superior to emery. In 9 x 11 sheets, put up in quires (24 sheets) and ¼-ream packages (120 sheets).



Wausite "Waterproof" Strips in 10-yd. coils. A new and convenient way of putting up abrasives. No waste from tearing. Has uniform width and clean cut edges. Furnished in ½, 1, 1½, 2 and 2½-inch widths. All grits.

Also supplied in 50-yd. rolls of any width and grit.

Wausite Discs. In all standard diameters and grits; and in three thicknesses—Regular, Heavy and Extra Heavy—covering all requirements of disc-grinding practice. The Extra Heavy (HH) grade has no parallel in the industry.



Wausite Discs are made in two formulas—"A" for hard metals and "C" for soft metals.

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Send for working samples, prices and "grit cards." Free.

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We invite correspondence with well-established distributors with sales organizations, competent to develop Canadian markets for our products, which include not only the above-named lines, but the full range of garnet and flint cloths and papers for use in woodworking; emery cloth and paper and other abrasive products.

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GREY IRON CASTINGS

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All our castings undergo a thorough inspection, and we guarantee them to be free from imperfections. Specify C. H. & V. W. Castings in your next order.

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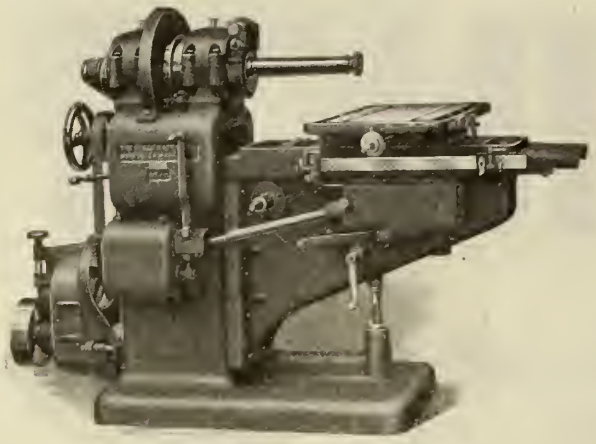
Canadian Hanson & Van Winkle Co.

LIMITED

Toronto Canada

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HEALD



STYLE No. 60 CYLINDER GRINDER

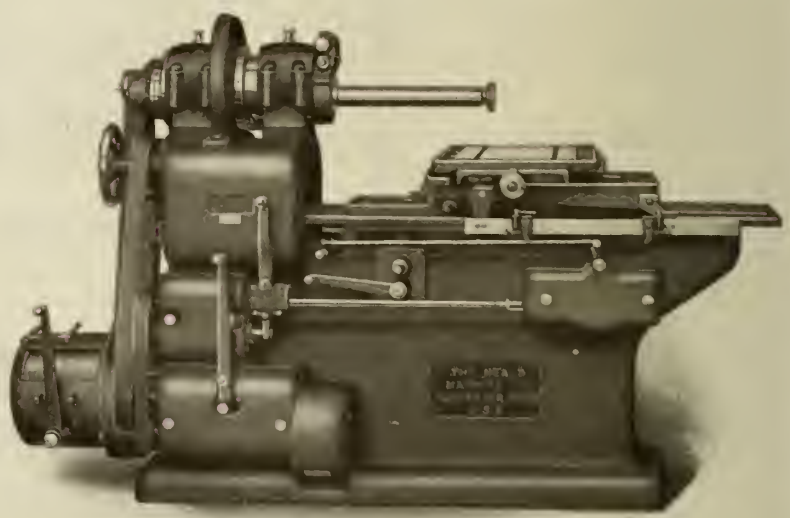
Machine Style No. 60, as shown above, has a large vertical adjustment of 3½ inches, obtained by movement of the knee casting clamped to the bed. This machine is particularly suited to garage work or any shop where a variety of different sized work requires a large vertical adjustment.

Machine No. 65 is our latest style, built for precision and production work. Notice the massiveness, giving rigidity,—centralized control of levers, giving convenience of operation, and that it is self-contained.

The Heald Cylinder Grinders are especially designed for internal grinding of holes in work of such shape that it is inconvenient or impossible to rotate in the usual manner when machining.

These machines are especially valuable for grinding airplane, marine or automobile engine cylinders. The ordinary method of smooth boring and reaming results in inaccuracies due to hard and soft spots in the casting, as well as springing of the thin cylinder wall. In grinding, the wheel revolves at a high speed in a true circular path, getting hard and soft spots alike, leaving an absolutely round hole.

Railroad shops are now using them to grind bearings in valve motion parts and piston rods, valve rods or brake parts, such as triple valves, etc.



STYLE No. 65 CYLINDER GRINDER

HEALD

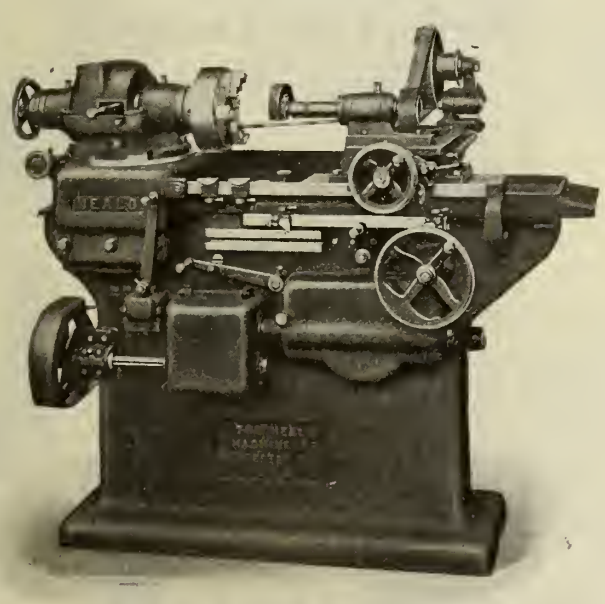
THE HEALD MACHINE CO.

BRANCH OFFICES—New York, 839 Singer Bldg., Philadelphia, 1308 Commonwealth Bldg.; Chicago, 26 South Jefferson St.; Detroit, 401 Marquette Bldg.; Cincinnati, 311 Provident Bank Bldg.; Cleveland, 721 Engineers Bldg.; WESTERN AGENTS—Eccles & Smith Co., Los Angeles, San Francisco, Portland, and Seattle; Salt Lake Hardware Co., Utaha, and Idaho; Hendrie & Bolthoff Mfg. & Supply Co., Colorado, and Wyoming.

INTERNAL GRINDERS

Heald Internal Grinders are built to handle work which can be easily revolved, such as bushings, cutters, ball races, hardened gears, gauges, cones, etc.

Each wheelhead is made up in a separate unit, instantly interchangeable. Twelve sizes of heads enable these machines to cover a wide range of work, which, together with the swivelling of the workhead, makes this machine indispensable in tool-rooms for grinding straight and tapered holes.



STYLE No. 70 INTERNAL GRINDER



STYLE No. 85 INTERNAL GRINDER.

Style No. 85, as shown above, and whose capacity is 10″ swing by 2″ long, was built for small, short work. The construction is very simple, and a large number of mechanical features have made it exceptionally well suited for rapid production. It works best on holes smaller than ¾ dia. x 1½ long.

Style No. 70 handles work 15″ dia. x 11″ long. It has both automatic and hand feed for the table. Several new features have been lately added, including friction clutch workhead for starting and stopping the work, longer base to enable the operator to run the wheelhead back when plugging. Also the guard over the wheel has been re-designed so that it entirely covers the wheel.

Let us send you catalogues, together with literature showing these machines working in various factories.

51 New Bond St., Worcester, Mass., U.S.A.

HEALD

FOREIGN AGENTS—Alfred Herbert Ltd., England; Societe Anonyme Alfred Herbert, France, Switzerland; Societa Anonima Italiana Alfred Herbert, Italy; Horne Co., Ltd., Japan; Wilh. Sonesson & Co., Sweden, Denmark, and Norway; Henri Benedictus, Brussels, Belgium; American Machinery Corporation and Sindicatio de Maquinaria Americano, Bilboa, Spain.

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Tracing them in the drafting room takes hours — sometimes days — of a highly paid man's time, always with a chance of errors.

The PHOTOSTAT accomplishes the same result in a few minutes at a cost of a few cents and without errors.



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in the drafting room, costs many dollars and takes hours or days of time.

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by hand for six or a dozen publications requires hours of work by an expensive man.

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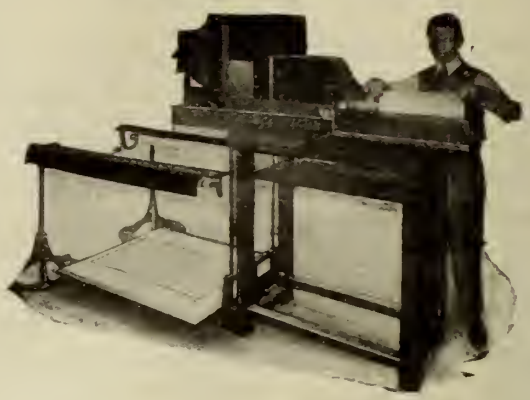
To Copy Catalog Pages

letters, reports, charts, etc., takes hours of a stenographer's time. The results cannot be exact duplicates and there are frequent errors.

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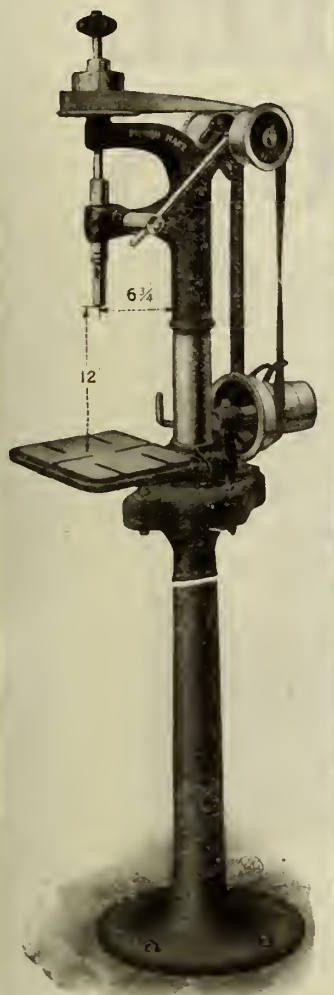
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BOSTON SAN FRANCISCO WASHINGTON

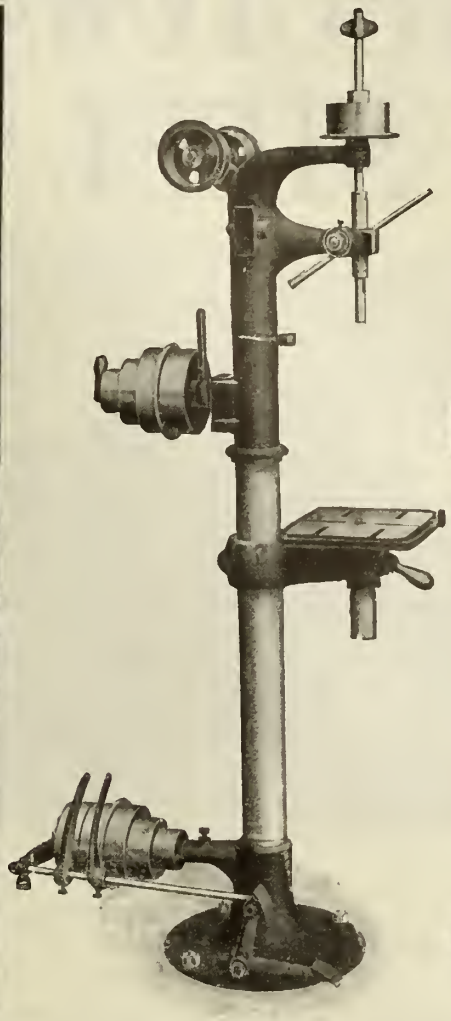
AGENCIES

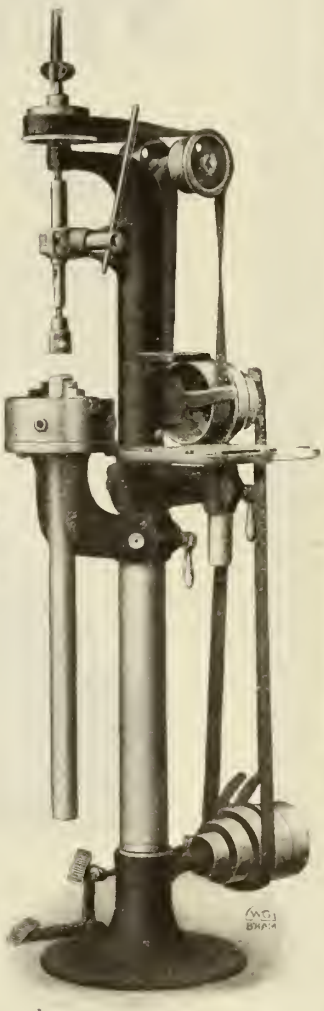
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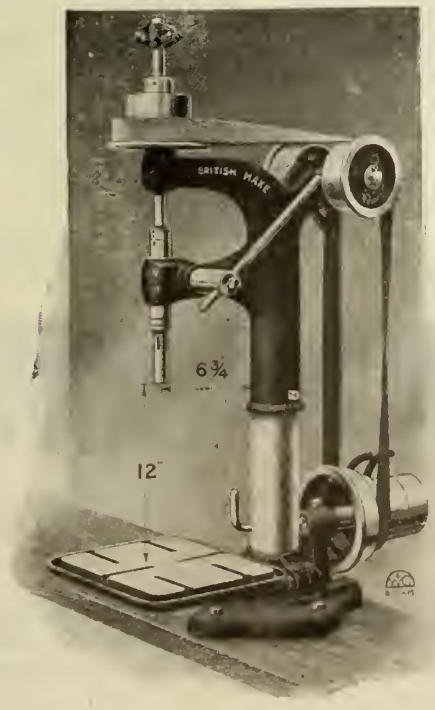






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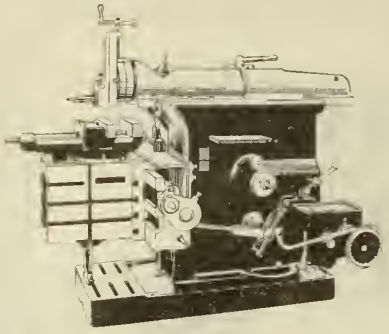
The Tube Company of Canada LIMITED

233 Dufferin Street - Toronto, Canada

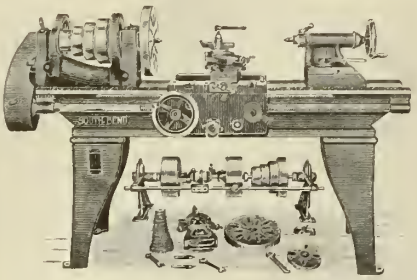
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Machine Shop and Pattern Shop Equipment

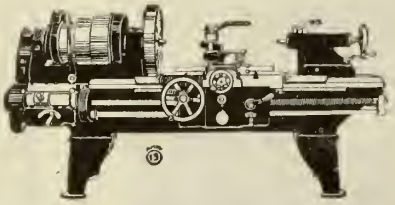
NEW AND USED



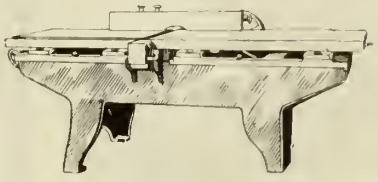
24 in. Gould & Eberhardt Shaper



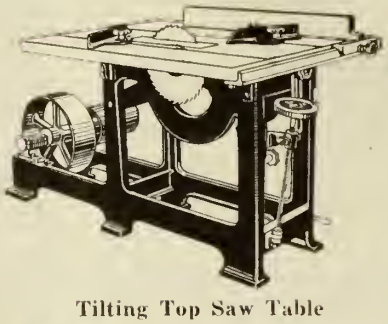
16 x 8 South Bend Lathe



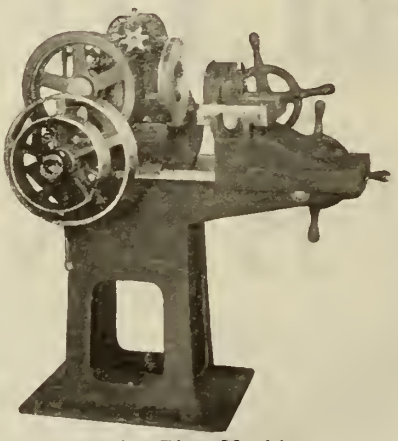
19 x 8 LeBlond Heavy Duty Lathe



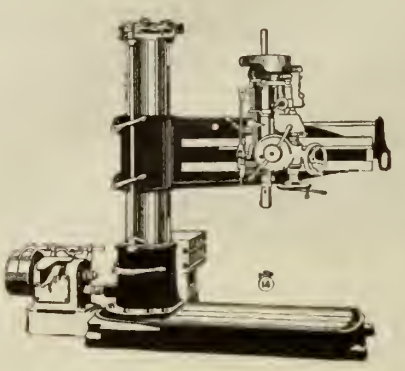
12 in. Buss Planer



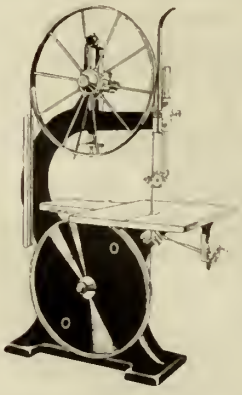
Tilting Top Saw Table



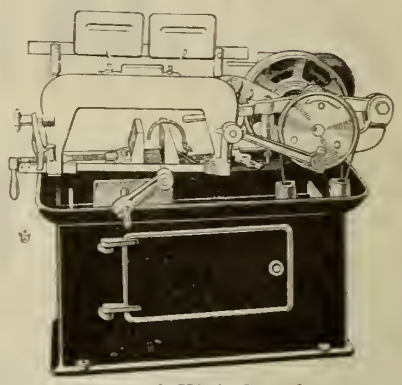
4 in. Pipe Machine



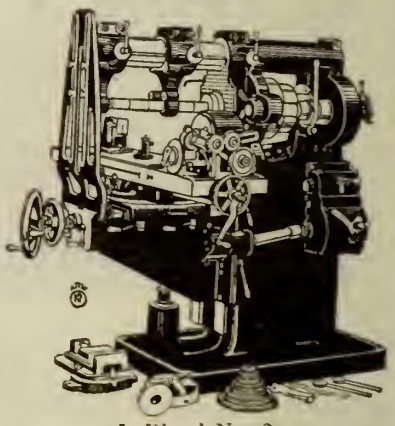
4 ft. Fosdick Radial Drill



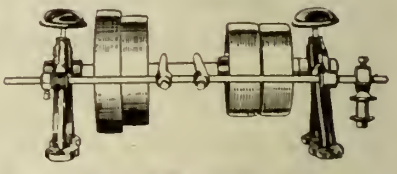
36 in. Band Saw



6 x 6 High Speed Hack Saw



LeBlond No. 2 Universal Miller





Double Bench Emery Grinder



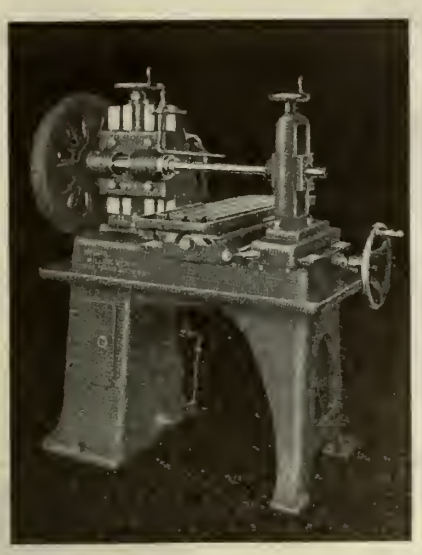
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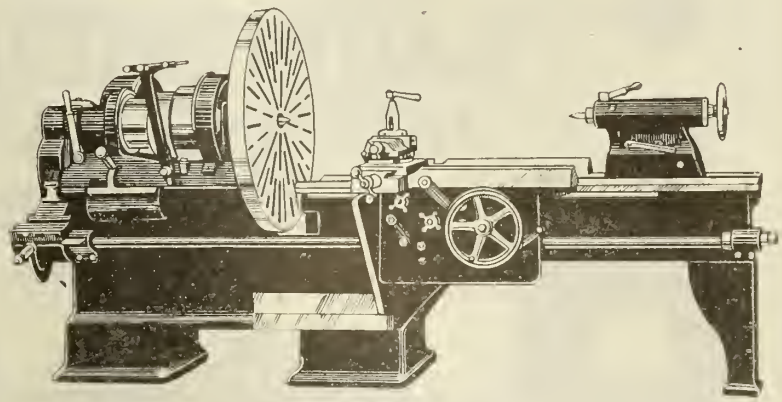
326 ST. JAMES STREET - MONTREAL, QUE.

Telephone Main 5200

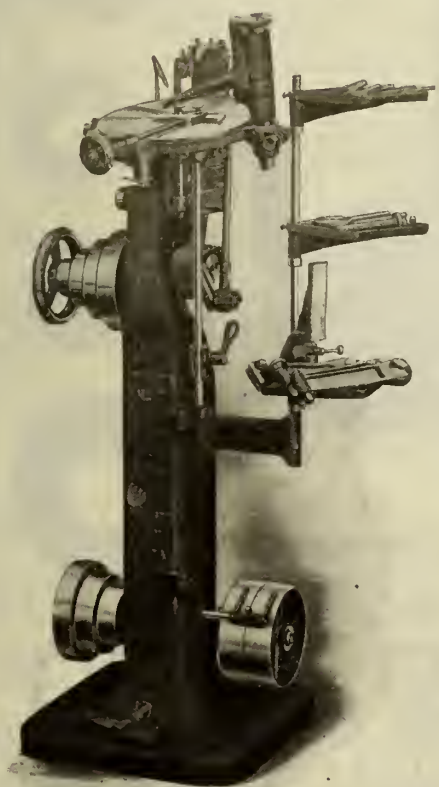
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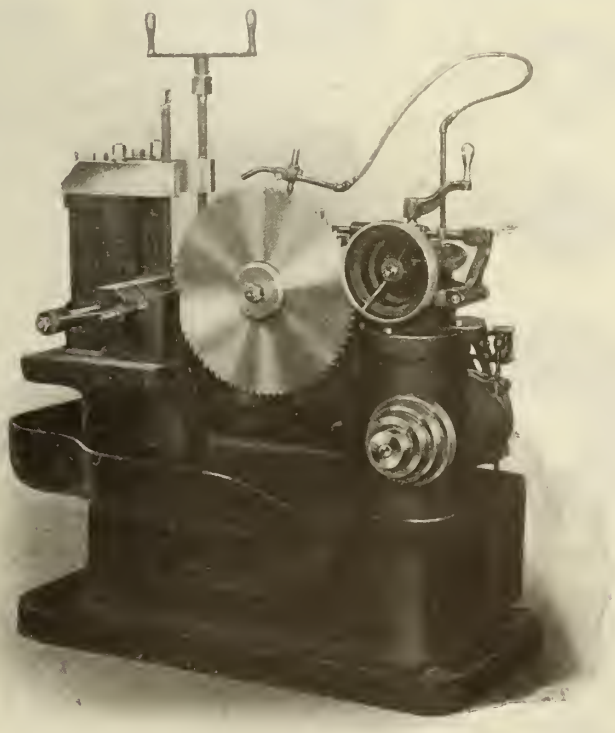
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No. 2 Vertical Filer



No. 4B Cold Saw

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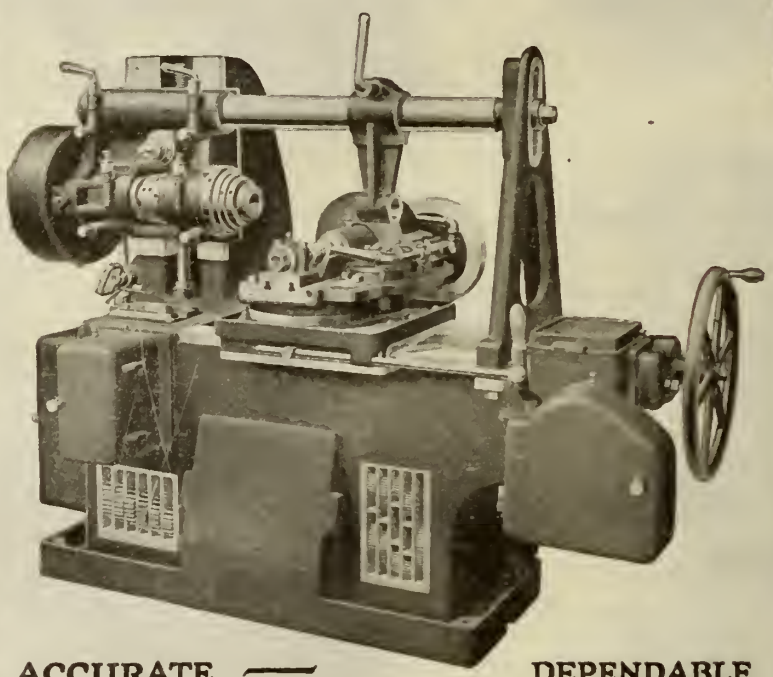
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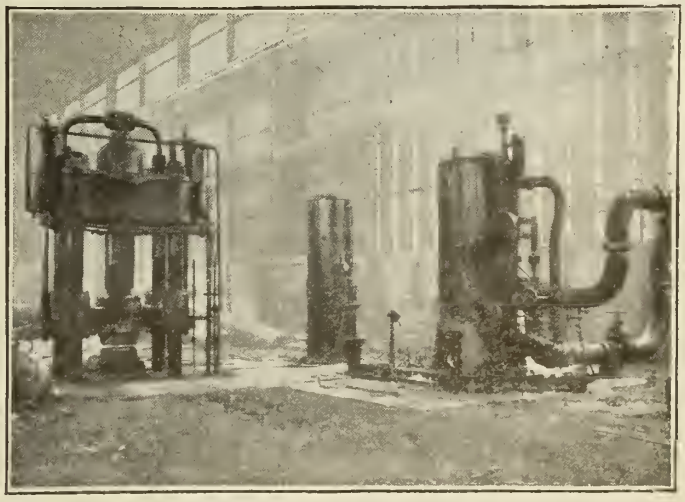
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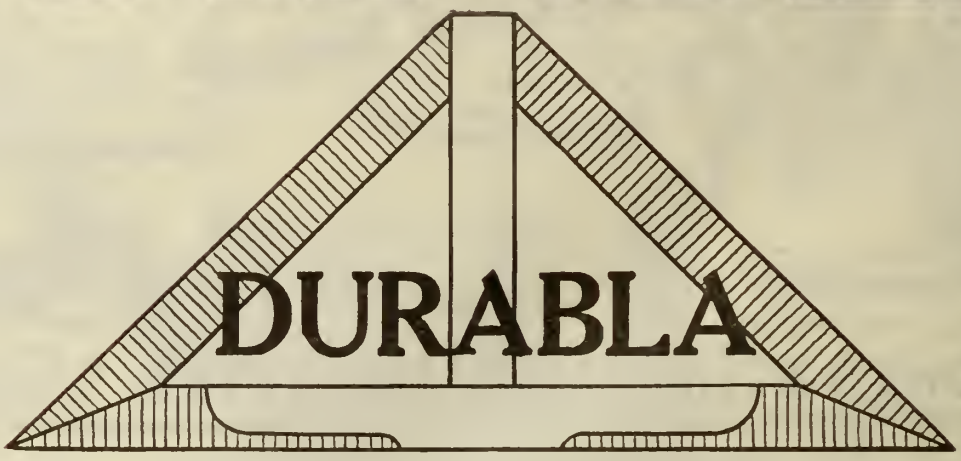
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Tight joints are made and maintained by DURABLA under the following severe services and conditions:

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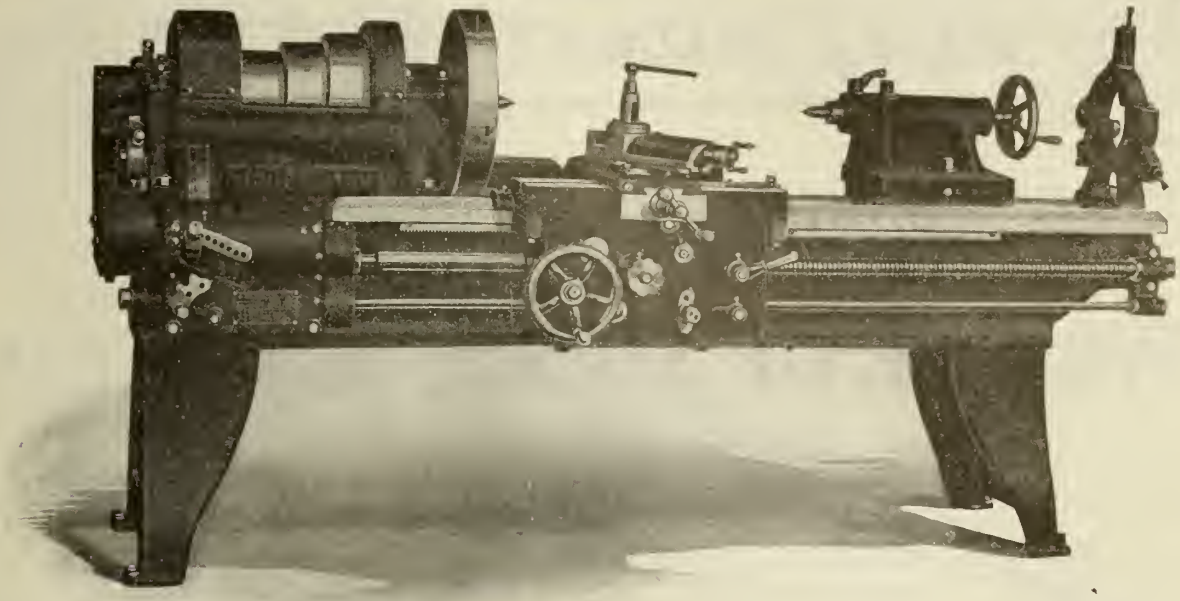
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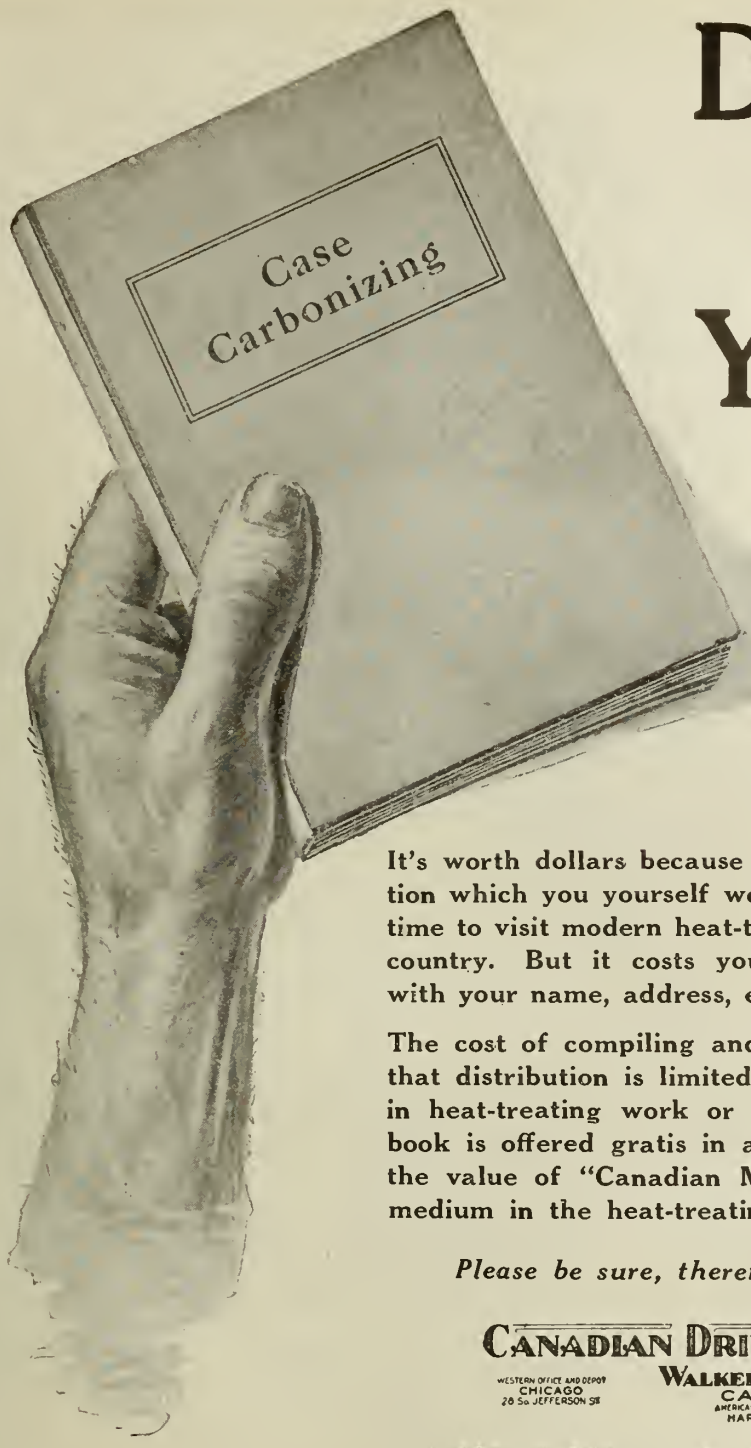
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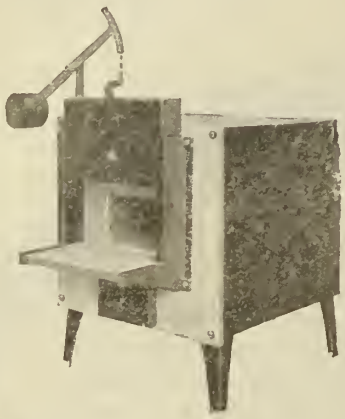
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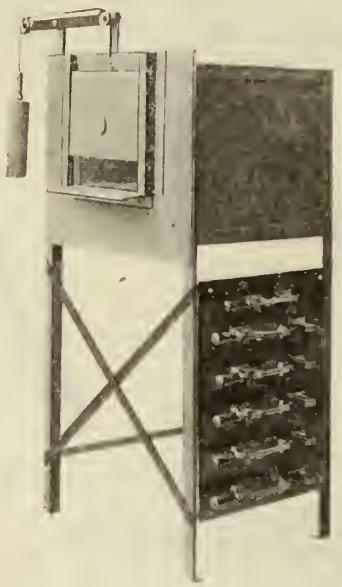
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Your present high speed reamers are undoubtedly as good as the manufacturer knows how to make them—but even the *best* of the old-style high speed reamers are bound to be inferior to

PEERLESS HIGH SPEED REAMERS

(Patented)

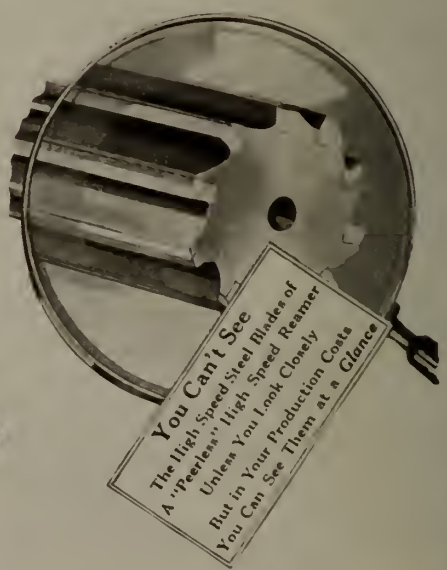
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It'll Surprise You.



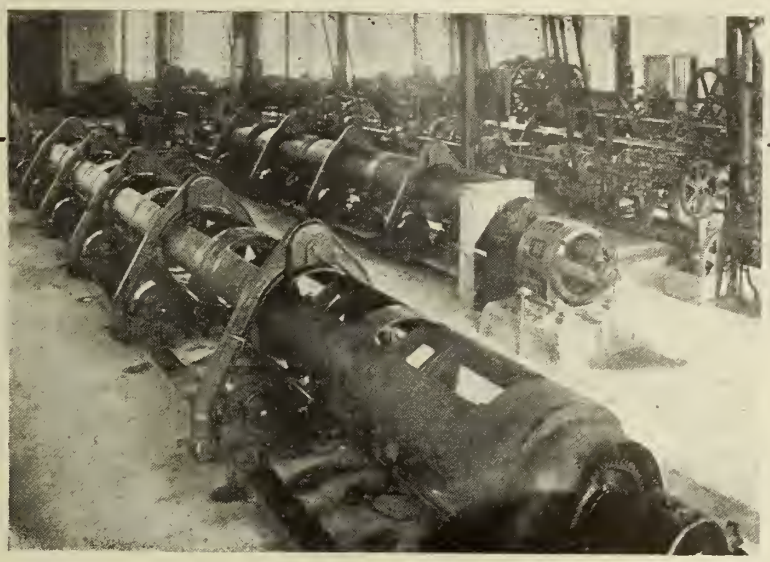
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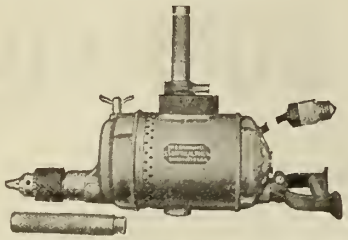
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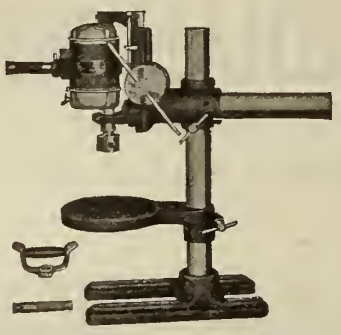
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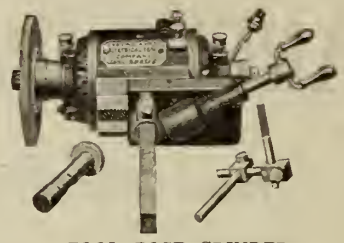
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The Motor Drill is detachable and can be used as a separate Tool.

SPECIAL FEATURES

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LA SALLE

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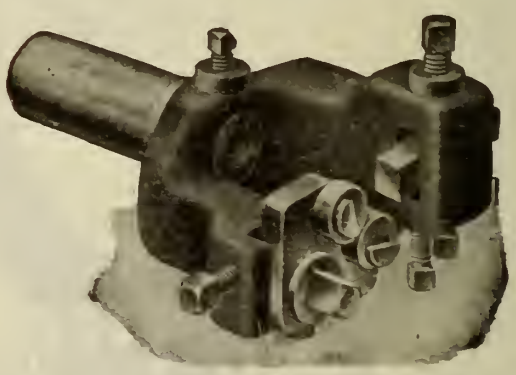
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For Wet or Dry Drill Grinding 1/8" to 2¼". Also 1/8" to 3½" dia.

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COMPLETE EQUIPMENT FOR CAPSTAN LATHES FULLY ILLUSTRATED IN OUR TOOL LIST E.

J. ACKWORTHIE LTD.
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"Starrett saws have convinced me they are best, by test. The blade that cuts quicker and lasts longer, cuts labor costs, too."

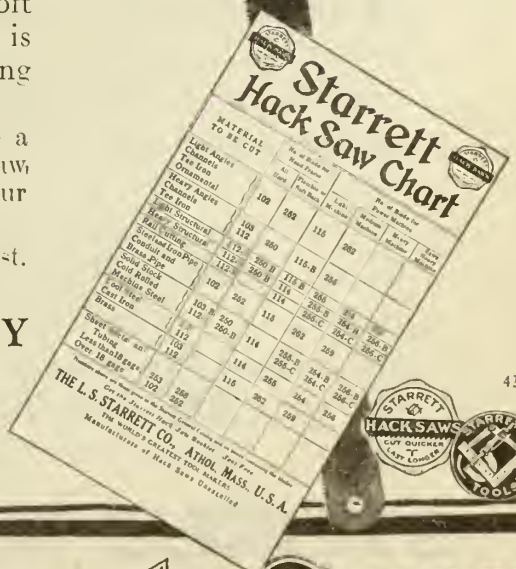
But for a blade to cut quicker and last longer, it must be the right saw for the material to be cut. Many saws will cut more than one metal. But no saw will cut all metals equally well. The pitch of the blade, for example, varies according to the kind of material cut. Cold-rolled stock and machine steel are cut efficiently with the saw that has 10 teeth to the inch. But brass and soft metals require a fine-tooth blade. And pitch is but one of the things to be considered in selecting the right blade.

To make it possible to select the saw best suited to a particular kind or shape of metal the Starrett Hacksaw Chart was designed. Use it, it will help you cut your cutting costs.

A copy of the chart will be sent free upon request. Send for Catalog No. 22 "3."

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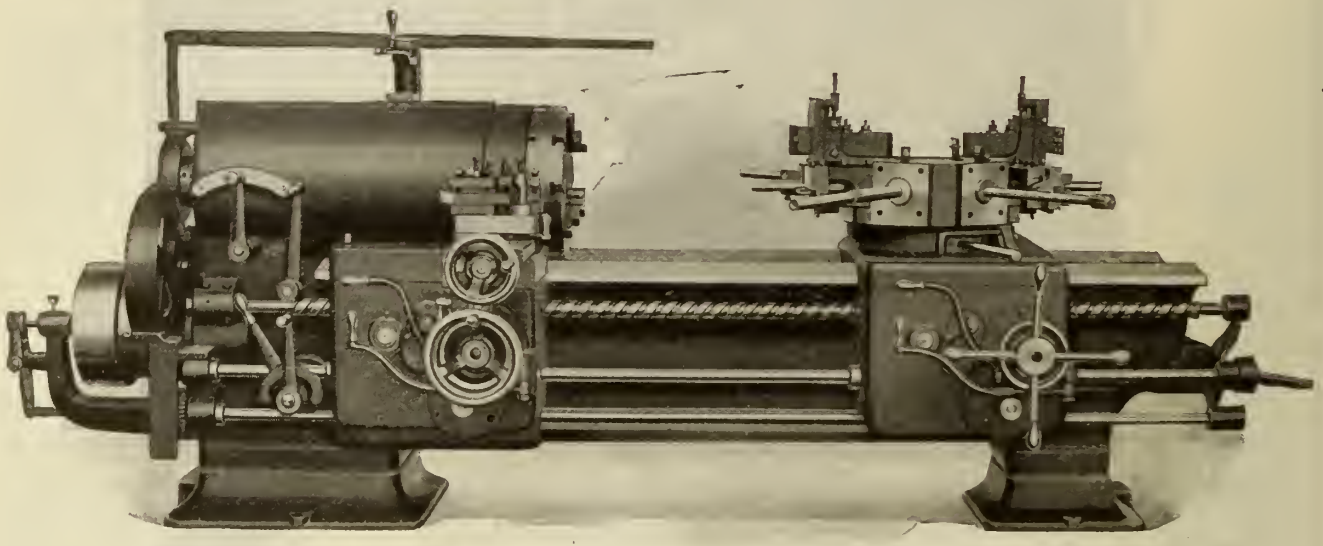
The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.



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Use Starrett Hack Saws

STEINLE



For CHUCKING

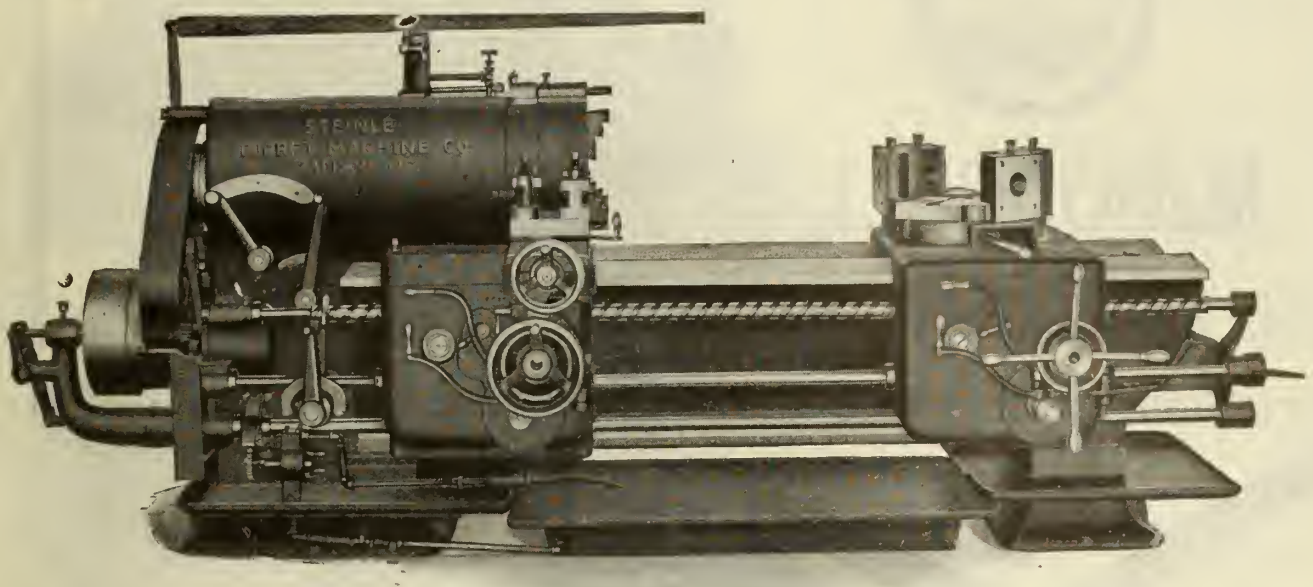
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The general massive construction, the ease of operation of all parts, the single pulley drive and thirty reversible spindle speeds, the rapid power traverse of both carriages, the power cross-feed of side carriage and general adaptability to special tooling equipment enabling satisfactory quantity and quality production—these are strong points well worth considering.

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or BAR JOBS

In view of present manufacturing conditions it is invariably performance that counts, and Steinle qualities given above are guarantees of satisfactory performance on your own work.

"If you want a recommendation of our Steinle you can get it from anyone in our organization who has come in contact with its production capabilities," said the general foreman of a manufacturing plant of creamery and dairy machinery and supplies who has had the opportunity of watching its performance since the installation at their plant in 1912.

Similar equipment will do equally well in your own plant.

Why not send us your blue prints if your requirements call for the installation of equipment of this character? We shall be glad to furnish you with production and tooling recommendations, or to have a qualified representative call and take up the question of Steinle methods as applied to your problems.

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ORIGINATORS OF THE SIDE CARRIAGE TURRET LATHE

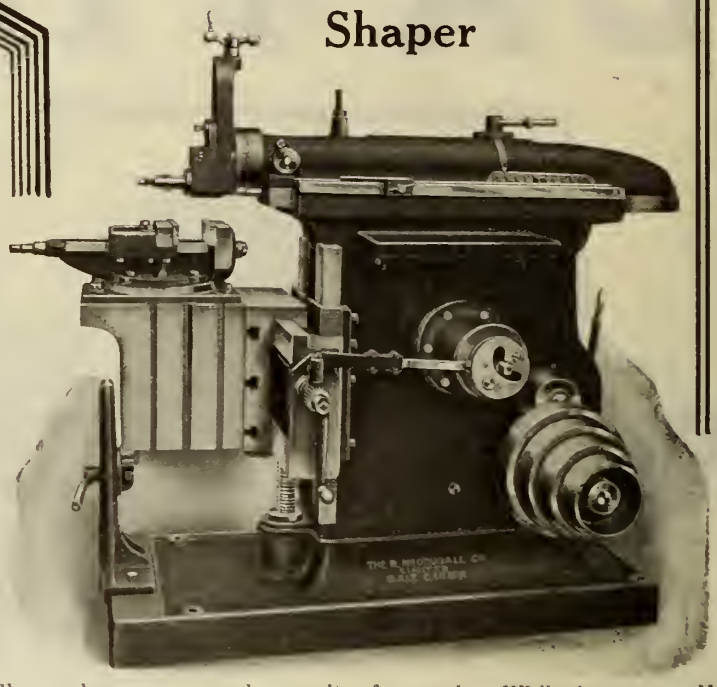
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ARE-MAC-DEE IS A GUARANTEE

McDOUGALL TOOLS

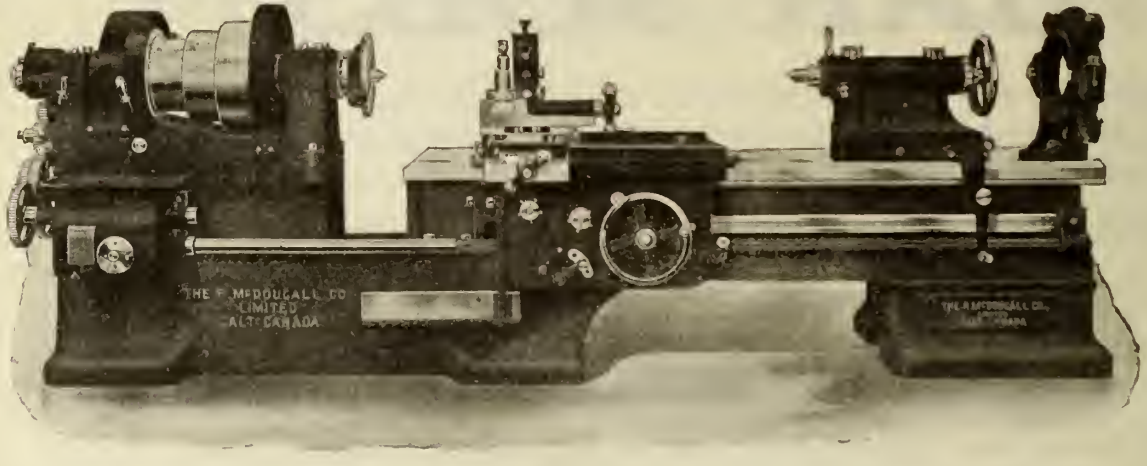
Built for Exacting Service

McDougall Shaper



This Shaper has an unusual capacity for work. While its design is simple, it is an embodiment of all the best and most essential features required for exacting Service.

McDougall Gap Lathe



Note the strong, rigid construction of this lathe. Every detail tends toward accuracy, ease of operation and increased production. Beds made in any length in all sizes.

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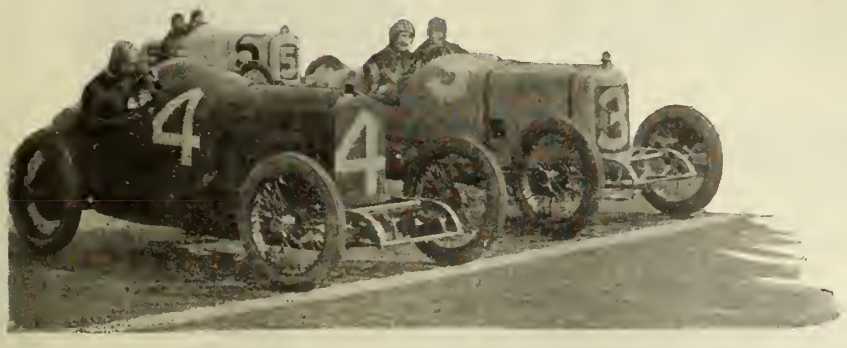
GALT, ONTARIO, CANADA

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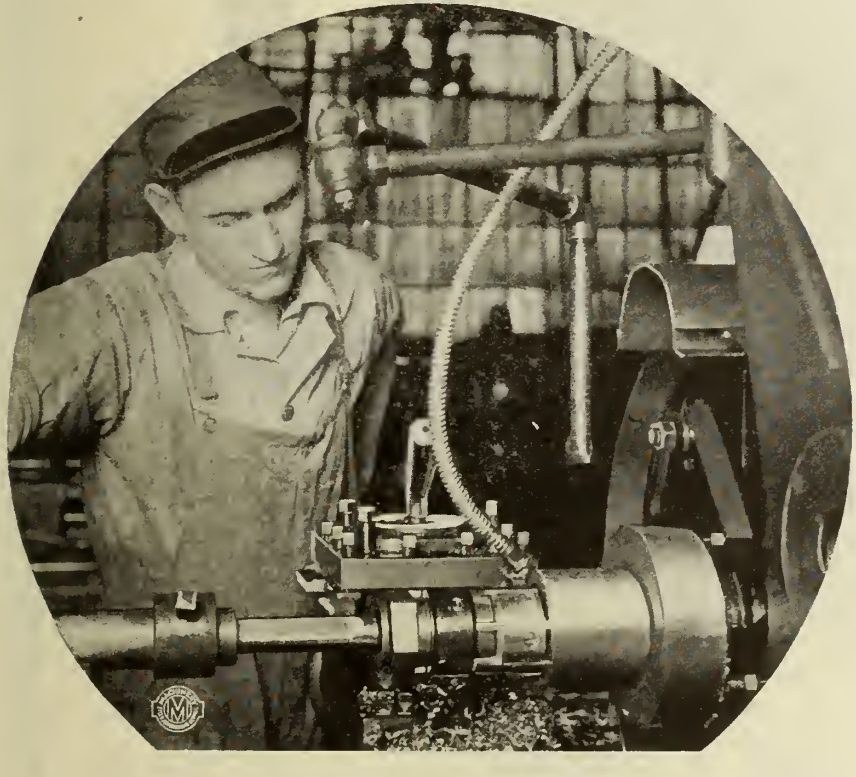
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SPEED WHERE IT COUNTS



All set for the signal to go-ahead with speed that counts



Is your Industrial Motor all set to go-ahead? Is every unit of its organization ready to give the speed that counts?

Since 12 per cent. of all manufacturing involves the production of holes the quality of your reaming equipment is of vital importance.

McCROSKY-SUPER
Adjustable Reamers

will bring your reaming department through a Long Run test with standard accuracy and maximum production.

The life of one McCrosky-SUPER Reamer exceeds that of a dozen solid reamers. The large range of forward adjustment insures accuracy to the bottom of the last hole. The patented locking device holds the blades as rigid as a solid tool. The toughness of the alloy steel absorbs the shocks of the heaviest jobs.

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Send for a copy to-day

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McCrosky
COST CUTTING TOOLS

McCrosky-SUPER Adjustable Reamers
McCrosky Wizard Quick Change Chucks and Collets for your Drill Press
McCrosky Turrets for your Engine Lathes
McCrosky Catalog describes them

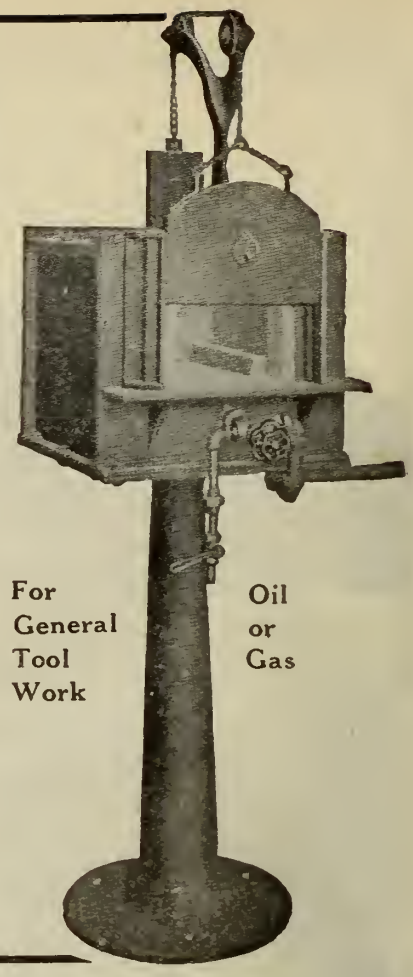
Heat Under Accurate Control

Here is an important factor in the heat treatment of metals. An intense heat, rapidly developed, and always under accurate control of the operator, are features that distinguish

BELLEVUE FURNACES

These tool forges are particularly adapted for the requirements of the small machine shop for annealing and tempering dies, cutters, reamers, etc.

Combustion is perfect and no flames come in contact with material. Built to stand the highest temperature. Doors are properly counterbalanced. In every way BELLEVUE FURNACES meet with the demand for durability, efficiency and convenience.



For General Tool Work

Oil or Gas

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Bellevue Industrial Furnace Company

Julius C. Hinz, President

703 Bellevue Ave. - Detroit, Mich.

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TYPE "R"

HARTNESS AUTOMATIC DIES

FOR REVOLVING SPINDLES

The No. 4 Type R Hartness Automatic Die has been designed for use on revolving spindles, either Vertical or Horizontal.

THREE TYPES OF CONTROLS

Outside button coming into contact with some set stop on the machine.

Regular knock-off by carriage coming to a stop while chasers, which are carried along by the revolving thread, pull the body away from the latch pin.

Sleeve control enable chasers to be released or locked at any time.

The Hartness Automatic Dies are the only automatic dies made that will, without the aid of lead screws, cut threads rivaling in lead accuracy those cut by the best engine lathes.

Jones & Lamson Machine Company

(DIE DIVISION)

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SPRINGFIELD, VERMONT, U.S.A.

503 Market St., SAN FRANCISCO California, U.S.A.

American Agents for Dies and Chasers:

P. H. Biggs, 1235-1237 West 9th St., Cleveland, Ohio.

E. L. Essley Machy. Co., Chicago, Milwaukee and Moline.

Robinson, Cary & Sands Co., St. Paul and Duluth.

Foreign Agents:

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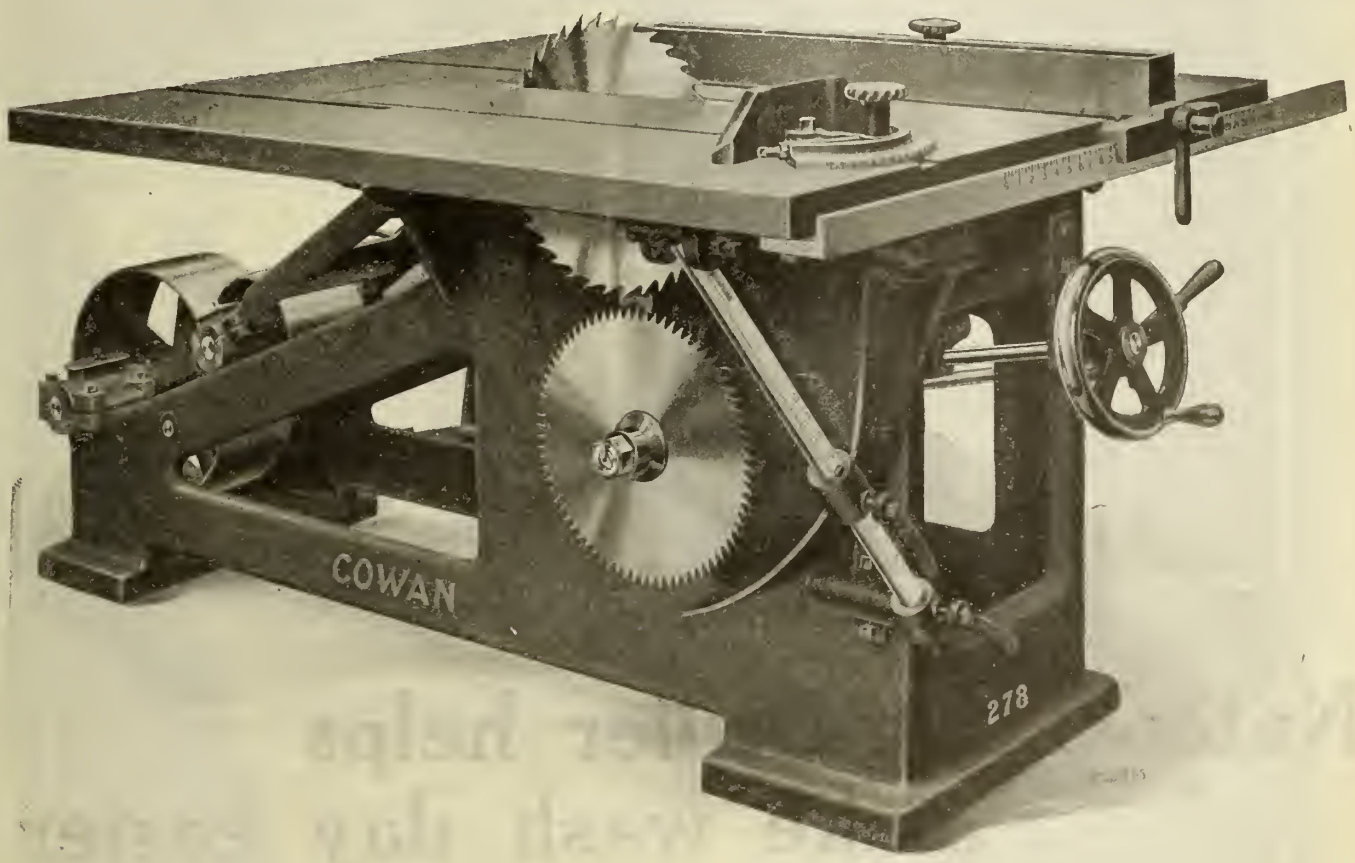
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Pattern and Carpenter Shops; Planing Mills; Sash Door and Furniture Factories; Shipbuilding Plants; Carriage and Wagon Shops, Etc.



Variety Rip and Cross Cut Saw 278

Easy and accurate adjustment and positive lock for saws. Handy and accurate tilting device
Extra wide belt. Belt tightener and belt shifter.
A Favorite Pattern, Carpenter and General Wood Shop Machine.

COWAN & COMPANY OF GALT, LIMITED

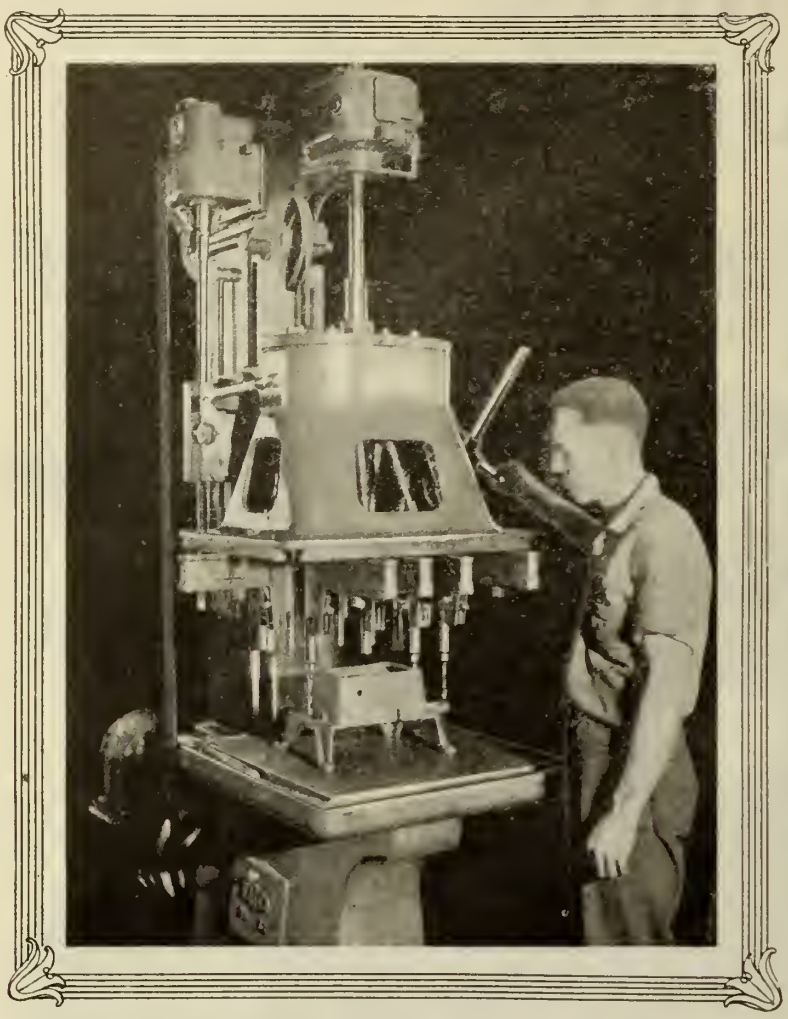
Manufacturers of

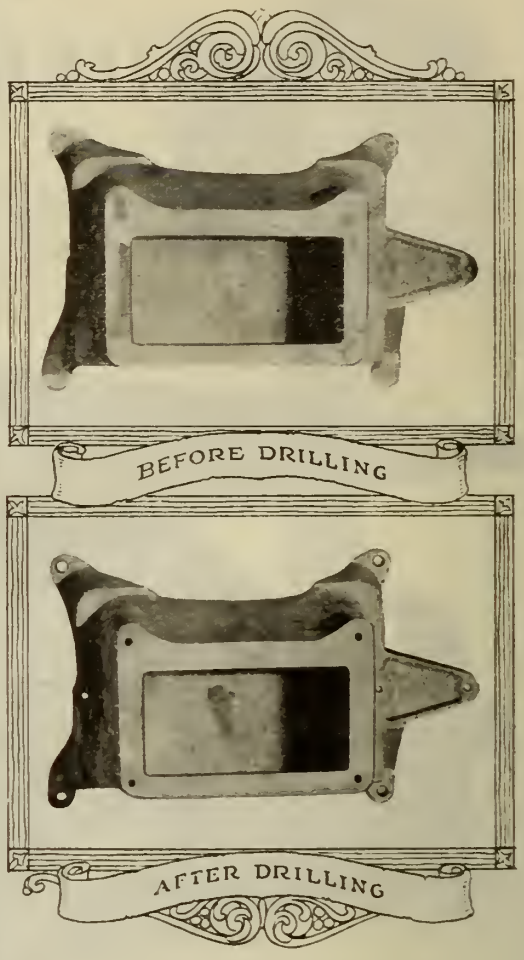
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MOULDERS	BORERS	SCROLL SAWS	GRINDERS
SHAPERS	LATHES	CROSS CUT SAWS	CLAMPS
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Office and Works: GALT, CANADA

If interested tear out this page and place with letters to be answered.

MULTI-DRILLERS NATCO MULTI-TAPPERS





Natco Multi-Driller helps make wash day easier

The Maytag Co., manufacturers of one of the best Washing Machines, use the Natco Multi-Driller to increase production on these labor saving machines.

In the piece shown here, which is the aluminum base for the engine, they drill three holes of different sizes to a depth of 5/8 in. They formerly used a single spindle drill on this job and got a production of 40 per hour. Now, using the *Natco Multi-Driller*, they get a production of 80 per hour.

And yet with this 50% increase in production they have reduced their drill breakage 20% and state tha · ow it is practically zero. But this result is to be expected when you consider the *strictly NATCO Patented Feature* which makes possible an *Independent Change of Speed for each Individual Spindle.* Those not in use are thrown into neutral, saving wear and power.

The *NATCO* is the only Multi-Driller on which you can drill large and small holes, perform different operations, such as drilling, reaming, spot facing, etc., simultaneously and still have each type of tool running at its correct working speed. The independent changes of speed are made easily and quickly while the machine is running.

NATCOS are made in sixteen (16) different sizes, and it does not matter how large or how small the work is, or whether you have one hole or many holes to drill, there is a NATCO that will suit your requirements better and more economically and with greater production than any other Drilling Machine.

We also design and build jigs and fixtures for use in connection with NATCO Multi-Drillers and Multi-Tappers.

THE NATIONAL AUTOMATIC TOOL CO.

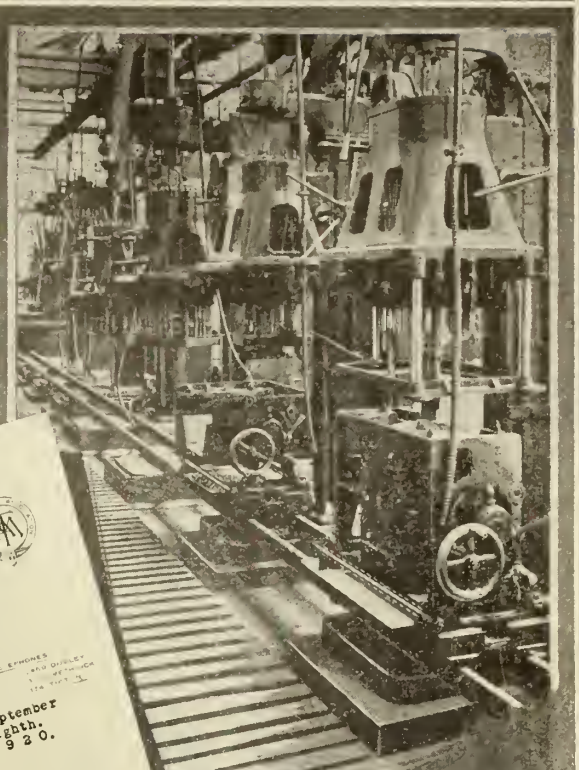
Richmond, Indiana, U.S.A.

Largest exclusive manufacturers of Multi-Drillers and Multi-Tappers.

"THE HOLE STORY IN ONE WORD"

NATCO

MULTI-DRILLERS
MULTI-TAPPERS
IN ENGLAND



CONTRACTORS TO THE ADMIRALTY, WAR OFFICE AND PRINCIPAL RAILWAY COMPANIES

A. HARPER, SONS & BEAN LTD
DUDLEY WORCS

Office of General Works' Manager

TMG/DR TIPTON.

September Eighth. 1920.

E.D.Frank, Esq.,
The National Automatic Tool Company,
Richmond, Indiana.
U. S. A.

Dear Ed.,

Passing through our Shop and looking at our battery of Natco Drilling Machines often reminds me of you, and so many people have expressed their admiration of that part of our Plant, that it has occurred to me you might like to get a photograph of your Machines as installed at our Tipton Works. These Machinee are quite a feature in our Plant and are doing most excellent work on our Crankcases for the 11.9 h.p. "Bean" Car.

The photograph is not particularly good but it conveys a fair impression of how the Machines are arranged and it may be of interest to you.

With kindest personal regards and best wishes

Yours very sincerely,

RECEIVED
SEP 20 1920
TICKLER | FILE

Showing battery of NATCO Multi-Drillers in the plant of Harper Sons & Bean of England, doing drilling and tapping.

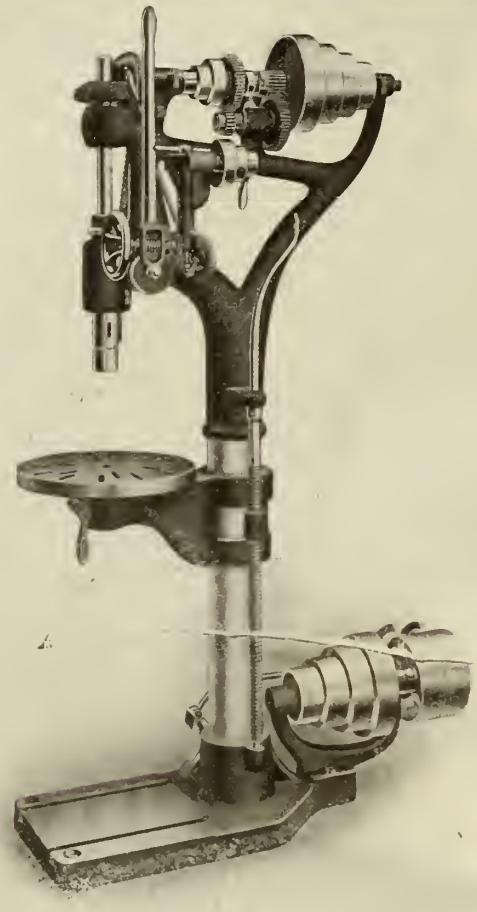
The above letter tells the "Hole" story.

THE NATIONAL AUTOMATIC TOOL CO.

RICHMOND, INDIANA, U.S.A.

Largest exclusive manufacturers of Multi-Drillers and Multi-Tappers

DENBIGH DRILLING MACHINES



BUILT IN FOURTEEN SIZES

By the aid of a very efficient plant and organization, we manufacture these machines in large numbers by mass production.

Prices and Deliveries are Right

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CABLES—ATHENIAN, SEDIST, LONDON



Built For *Service*

This BLOUNT Motor-driven Lathe is well adapted to all speed lathe uses. It is of late design, and has a number of features in which you will be interested. Provided with constant-speed motor. Lathe spindle made of hollow, high-carbon steel, ground to size and bored for Morse taper. Runs in self-oiling bronze bearings.

"We will accept Canadian funds at par"

J. G. Blount Co., Everett, Mass., U.S.A.

NOVO-SUPERIOR

HIGH SPEED STEEL

INTRA STEEL GIBRALTAR STEEL

Tool Steel for Every Purpose

Swedish Lancashire Iron

Twist Drills, Taps, Hack Saw Blades, Milling Cutters, Files, Etc., Music Wire for Springs, Steel Balls. Cold Rolled Tool Steel in Strips and Sheets, Circular Saws, Machine Knives.

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332 St. James Street, Montreal

Sole Agents for

JONAS & COLVER, LIMITED
Novo and Continental Steel Works, Sheffield, Eng.

H. BOKER & CO., Inc.
New York, N.Y.



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400-Ton Hydraulic Wheel Press

This Made-in-Canada Press is built to operate direct from Accumulator at 1500 pounds per square inch pressure.

Perrin for Reliability

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TORONTO

GENUINE EMERY

Sizes 180, 160, 140, 120, 110, 100, 90, 80, 70, 60, 54, 46, 40, 36, 30, 24, 20, 18, 16, 14, 12, 10, 9, 8, hole.

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Emery Glass Flint Garnet Corundum Carborundum	Paper and Cloth	In Sheets, Rolls, Discs, Bands, Strips and Tapes, &c.

JOHN OAKEY & SONS
LIMITED
WELLINGTON MILLS
LONDON, S.E.1, ENGLAND

AGENTS:
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Winnipeg, Man.
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ROCKFORD
—the best for varied work

General manufacturing plants prefer the **Rockford Miller** because they require a machine which they can depend on to do any work within its range to the complete satisfaction of the inspection department.

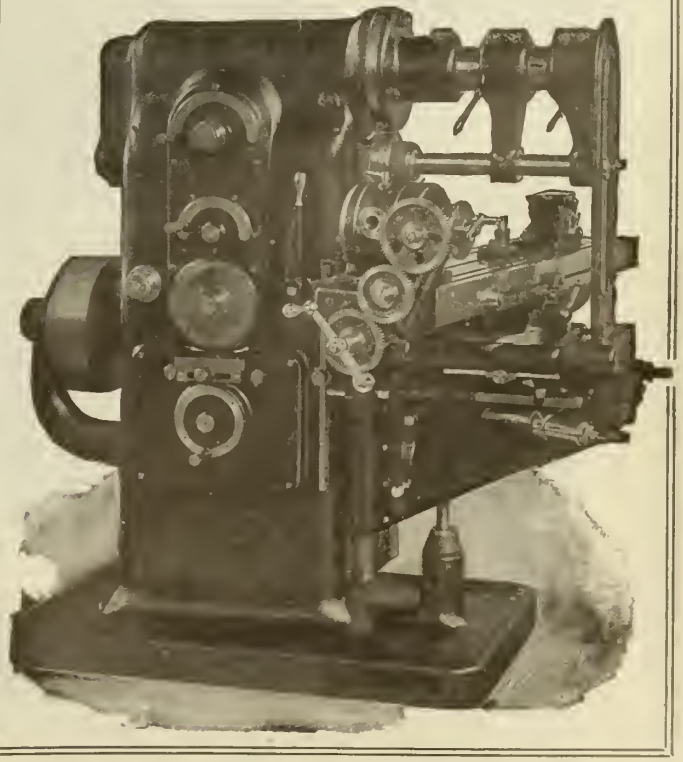
Simplicity of operation and **absolute rigidity under every condition** are distinctively **Rockford** features. They have made this the very best machine for general manufacturing.

Full details on request

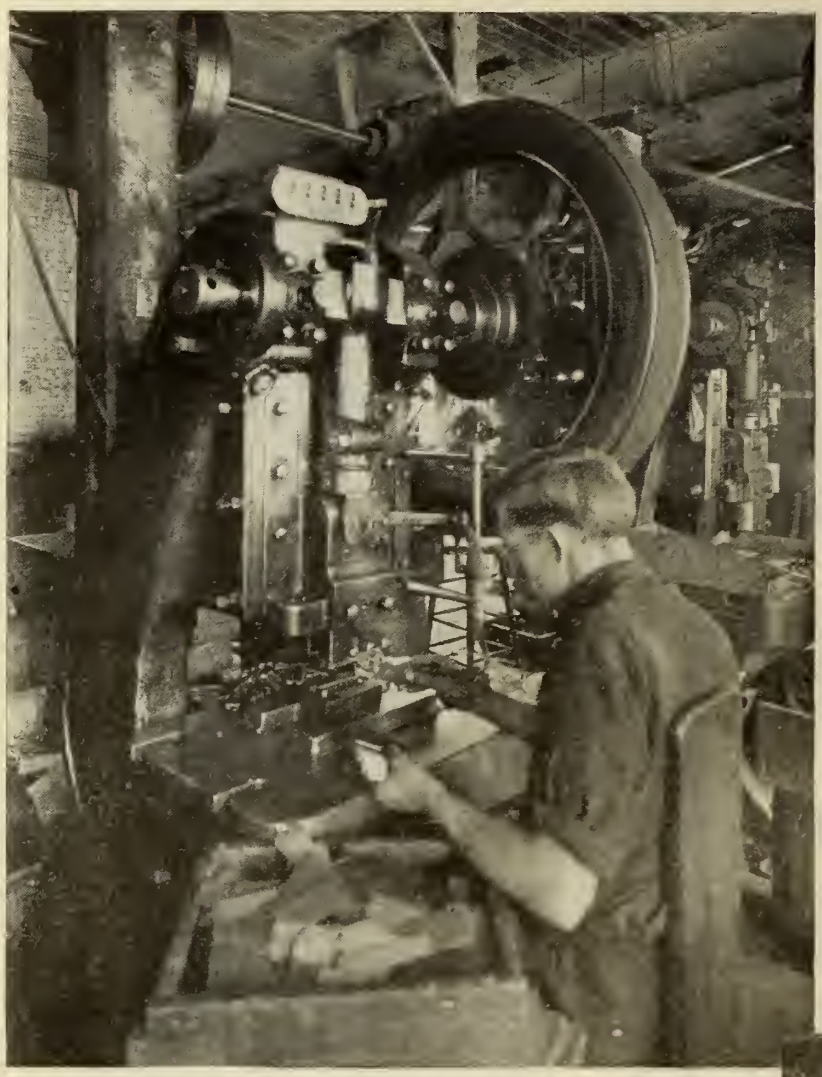
Rockford Milling Machine Co.
Rockford, Illinois

Agents:
Rudel-Belnap Machinery Co.
Toronto

A. A. Jones & Shipman, Ltd., Leicester, England, Great Britain; Louis Besse, Paris, France and Belgium; Societa Anonima Adler & Co., Milano, Italy, Italy and Colonies; Rylander & Asplund, Stockholm, Sweden, Scandinavia; Casamitjana Hermanos, Barcelona, Spain, Spain and Portugal; Selson Engineering Co., Melbourne, Australia; M. Mett Engineering Co., Petrograd, Russia.



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Kitchen and Table Cutlery

Produced Entirely on "BLISS" Presses

These photographs, taken in the plant of H. C. Hart Manufacturing Company, Unionville, Connecticut, illustrate the method of producing low-priced Kitchen Cutlery in large quantities.

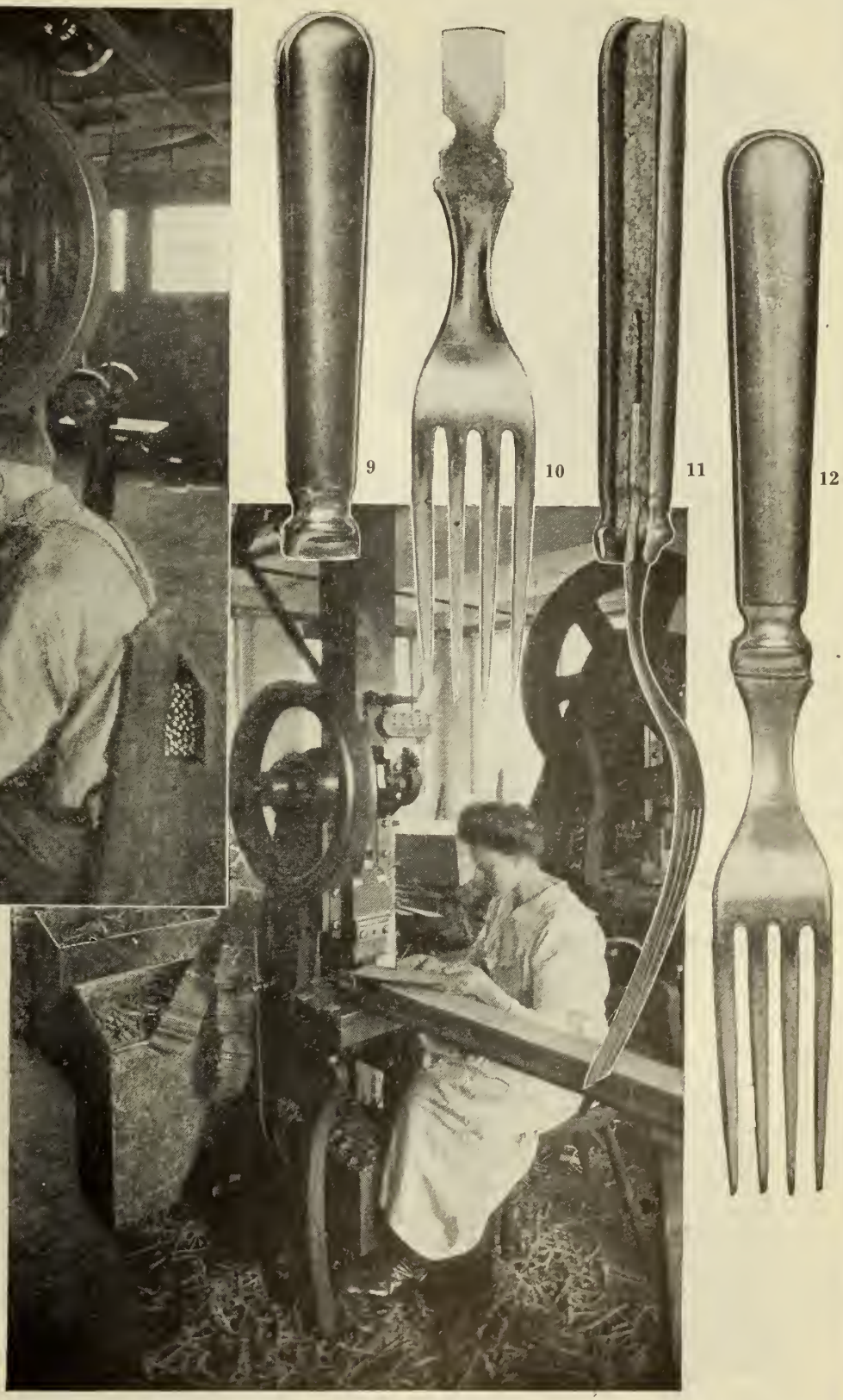
"BLISS" Presses are used for all operations excepting grinding and polishing. The first operation is cutting blanks. Fig. 1 shows blank for handle; Fig. 4, blank for knife blade, and Fig. 5, blank for fork.

The second step is panelling the handles, Fig. 3; the cork filler for the handles is blanked, Fig. 2, and the two successive operations in cutting the fork tines, Figs. 6 and 7.

The final steps are bending, assembling, and closing the handles, illustrated in Figs. 9, 10, 11 and 12.







The photographs of "BLISS" Presses in operation show, on the opposite page, panelling of handles; at the top of this page, assembling and closing, and, at bottom, blanking of cork fillers.

A very high production rate is maintained on these operations—approximately 20,000 per 9-hour day on blanking, 12,000 on panelling, and 5,000 for the assembling and closing. All figures are per machine day.

"BLISS" Presses are adapted to all kinds of Metal Stamping, increasing production and making it more economical.

E. W. Bliss Company

Main Offices: BROOKLYN, N.Y., U.S.A.
American Factories: BROOKLYN, N.Y., *and* HASTINGS, MICH.

BLISS 1857 — BLISS 1920

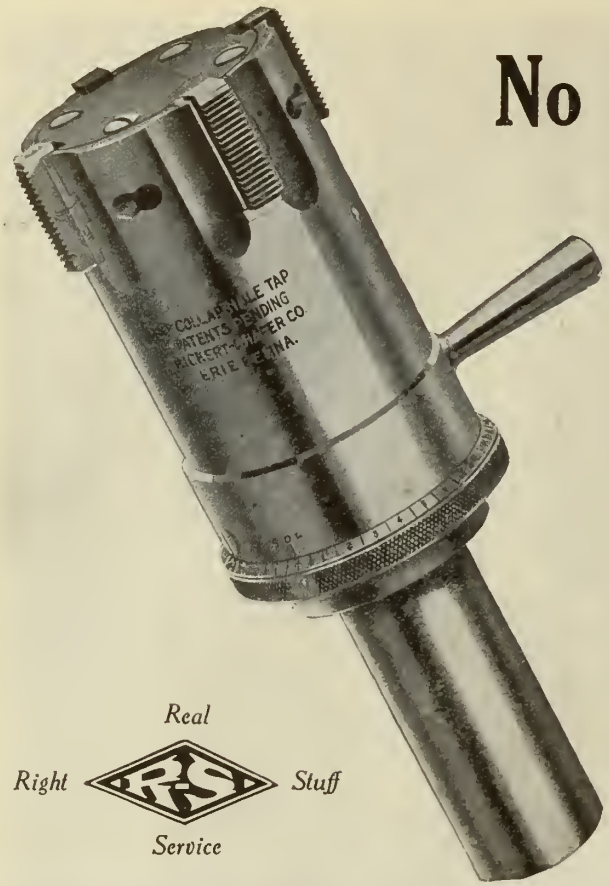
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CINCINNATI, Union Trust Bldg. BUFFALO, Marine Bank Bldg. ST. LOUIS, Boatmen's Bank Bldg. PITTSBURGH, Keenan Bldg.

No. 140

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Real Right RS Stuff Service

No Sizing Tap Required

"A"

When a 5″ model "P," R-S Collapsible Tap was tried out at a famous automobile axle plant in Detroit recently, it was found capable of such close adjustment that follow-up sizing taps were unnecessary.

AND IT IS **POSITIVE ACTING.**

Send for Bulletin VII, which describes the design, construction and action of this new and marvelous tool.

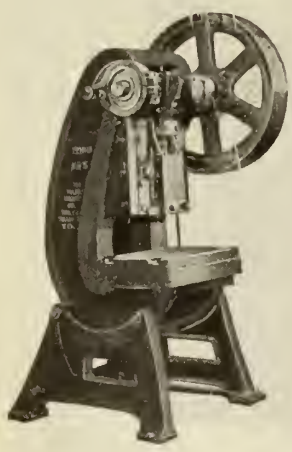
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Branches:

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The "TOLEDO" Inclinable Presses



Ease and simplicity of operation — speed and accuracy of performance — low maintenance distinguish these presses. Supplied in over 20 sizes, adaptable to practically every kind of blank cutting, forming, perforating, drawing, shaping and combination die work.

Details of superior features promptly furnished.

The Toledo Machine & Tool Co.

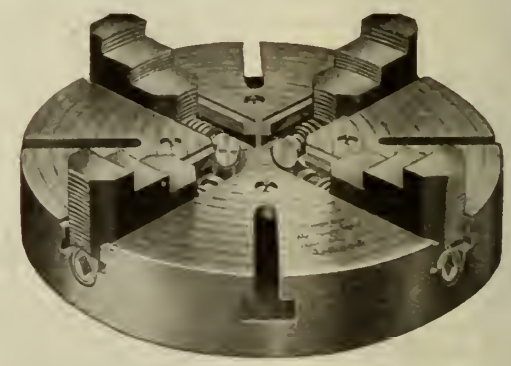
Toledo, Ohio

Representatives: Allied Machinery Co. of America, 19 Rue de Rocroy, Paris, France; Via XX Settembre 12, Turin, Italy; 16 Siedengasse, Zurich, Switzerland.

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INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



THE UNION STEEL BODY CHUCKS

are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

UNION MANUFACTURING COMPANY

New Britain, Conn.

New York Office: 26 Cortlandt Street

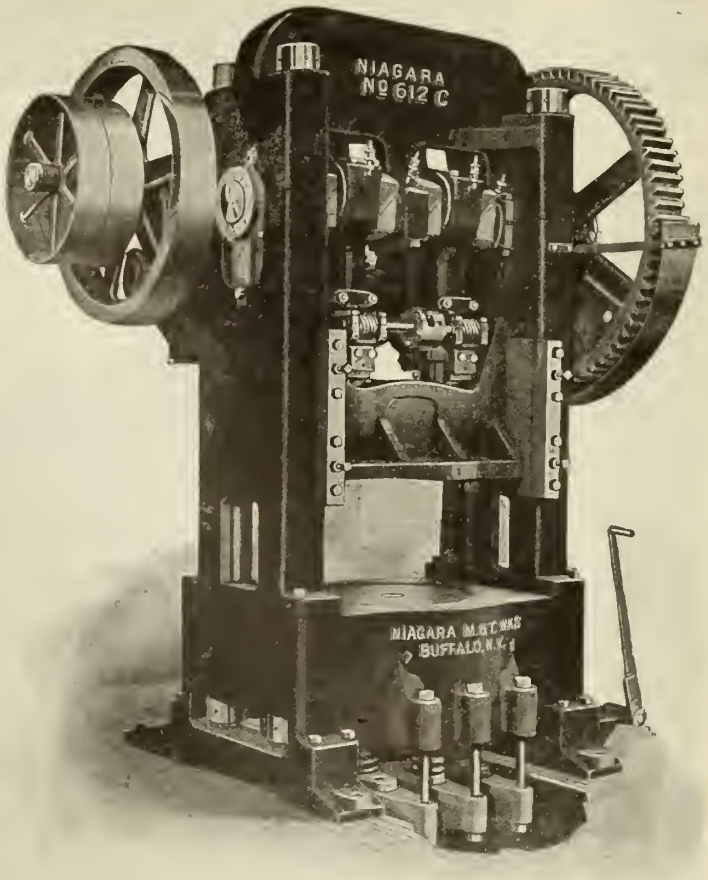
Makers of a complete line of chucks

NIAGARA
Power Presses
Massive, Accurate, Powerful

Carefully proportioned construction with scientific distribution of the weight and correct application of tremendous power insures the accuracy of Niagara Power Presses: operating conveniences guarantee economical production.

Built in weights ranging from 250 to 100,000 pounds, sizes to 10' between the housings. The cut shows our No. 610-C for blanking, forming, punching and stamping.

Catalog?



NIAGARA MACHINE & TOOL WORKS

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"PALMETTO"

gives longer service under hard conditions than other packings because it has the quality that in the end means

REAL ECONOMY

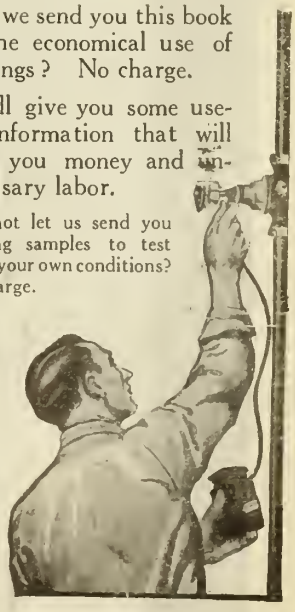




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It will give you some useful information that will save you money and unnecessary labor.

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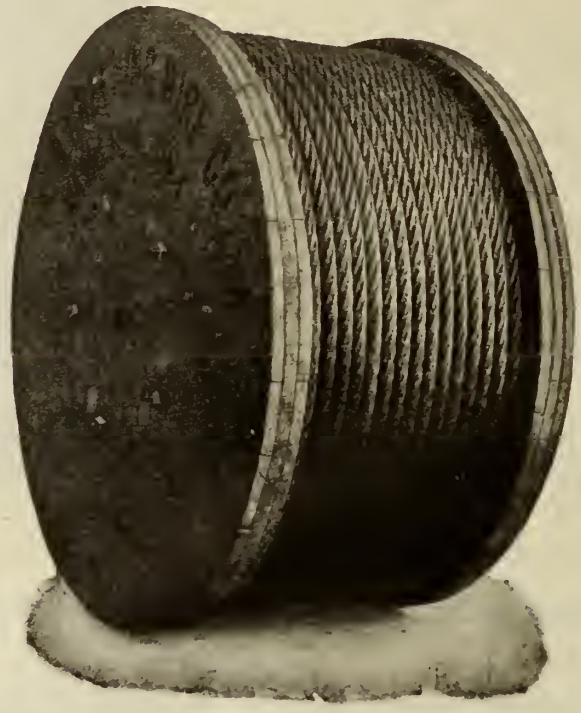
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Quick Deliveries.

The B. Greening Wire Co. Limited

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Little Wheels *for* Big Jobs

IT'S even more necessary to have the right wheels in the tool room than on any other grinding job.

Any old wheel won't do!

Drawing the temper and checking tools is a whole lot more expensive than getting the right wheel.

The proper wheel for your tool room work can be found in our complete stock of Aloxite Wheels.

For reamers, cutters and similar tools the condition is well met with 40 to 60 grit, M to N grade Aloxite wheels. For large, heavy tools we generally recommend 24 to 36 grit, H to I grade.

Let us give you just *the right wheel in the right place*—then standardize on—

Aloxite in the Tool Room



The Carborundum Company
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Manufacturers:

The Sheffield Twist Drill & Steel Co., Ltd.

Works: Summerfield Street, Sheffield.

To **PROMOTE TRADE** within the **EMPIRE, CANADIAN MANUFACTURERS** will find that **"DORMER BRAND DRILLS"** meet all requirements. **QUALITY DRILLS** for quick drilling—USE **"DORMER."**

Sheffield Engineering Supplies,
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High Speed Twist Drills

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Dunbar

Springs *for* Every Use

We have been making springs of all kinds for 70 years. Let us advise you when in difficulty.



Tell us the purpose for which the spring is intended, and experts will gladly co-operate to see that you get the design best suited to the purpose.

Dunbar Springs are thoroughly tested for **accuracy** and **quality**. Send us specifications, for estimates.

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Engineers, Manufacturers and Erectors of Steel Structures

Industrial Bridges, Buildings, Towers, Smoke Flues and Stacks, Chutes, Coal Bins, Ore Bins, Tanks, Cranes, Engine Houses, Grain Elevators, Derricks.

Structural Steel and Steel Plate Work, and a combination of the two lines.

Prompt Deliveries Assured

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for a large variety of grinding

if your variety of grinding is large invest in a Manhattan Universal Grinder. It is capable of handling cylindrical or internal grinding with the utmost in speed and accuracy.



Write for details.

Manhattan Machine & Tool Works

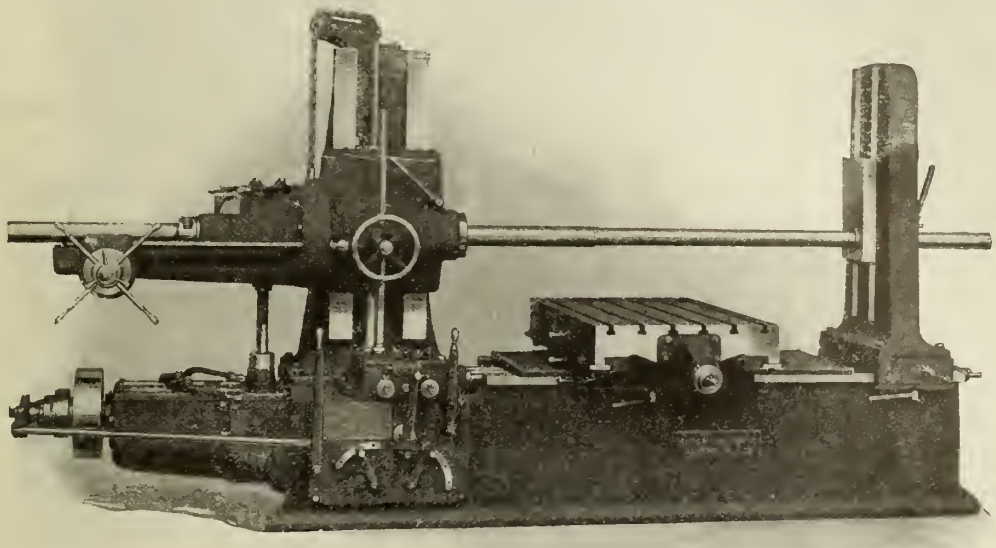
Grand Rapids, Mich., U.S.A.

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The "PRECISION" BORING DRILLING MILLING MACHINE

(*The Original* "LUCAS TYPE")



is made in THREE SIZES

3, 3¾ and 4½ inch spindles respectively, of the same general design and with the well-known

LUCAS

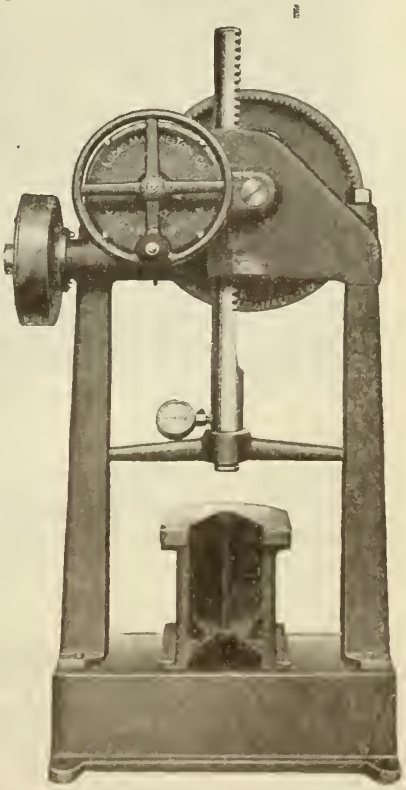
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The LUCAS POWER FORCING PRESS

is the quickest means known for handling all shop pressing jobs within its range, because the power is always there, ready for instant application. The operator applies, controls, graduates and releases the pressure instantly by means of the ONE controlling handwheel.

THE BELT DOES THE WORK

Made in three sizes—15, 30 and 50 tons capacity.



Lucas Machine Tool Co.

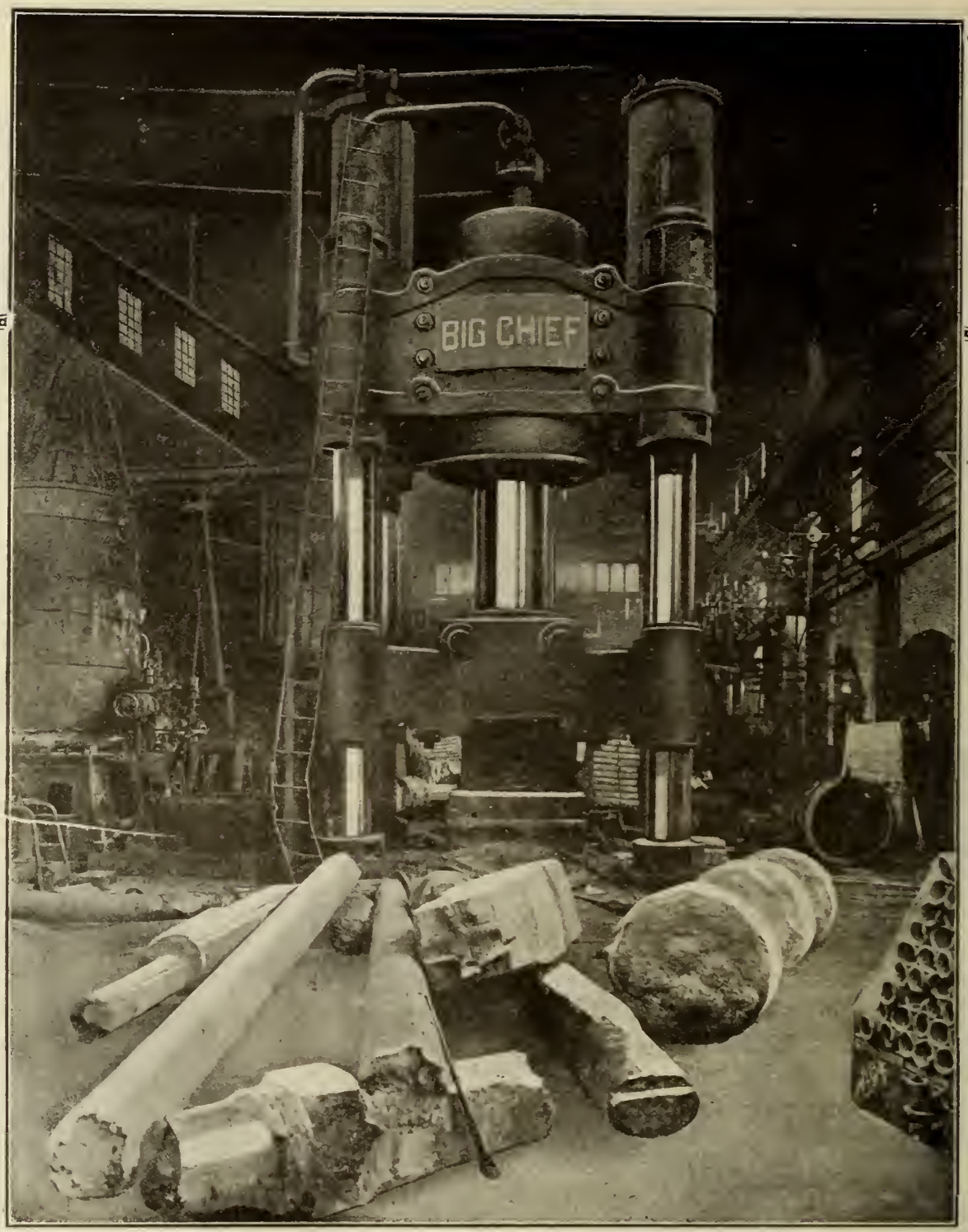
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The product of a modern steam-hydraulic press is denser and more homogeneous than can be obtained with the steam hammer, due to the effect of the blow of the latter not penetrating to the centre, in contradistinction to the uniform kneading effect of the press; while the amount of work that can be done by the latter at one time with little variation in temperature, strongly tends towards a better product. The greater uniformity and reliability of steam hydraulic forgings make their use imperative wherever high-class products are required.

We Will Be Glad to Answer Your Enquiries.

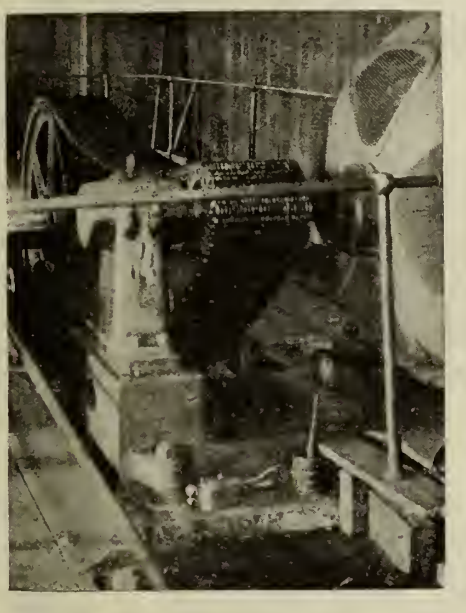
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Head Office : NEW GLASGOW, N. S.

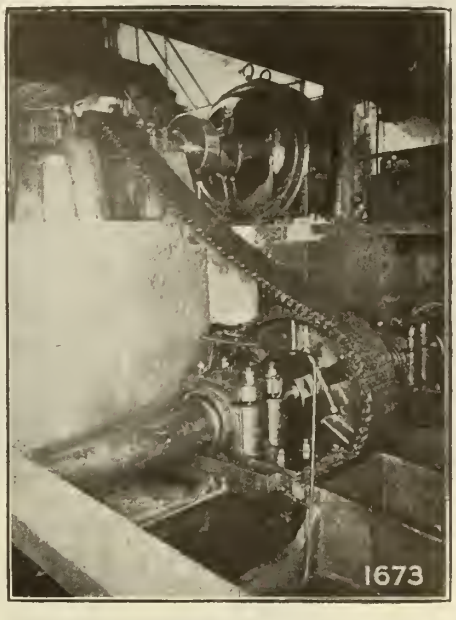
RENOLD
DRIVING CHAINS



175 H.P. Main-shaft Drive

THE SYMBOL OF QUALITY H R

The Chain With a World-Wide Reputation



125 H.P. Line-shaft Drive in Paper Mill

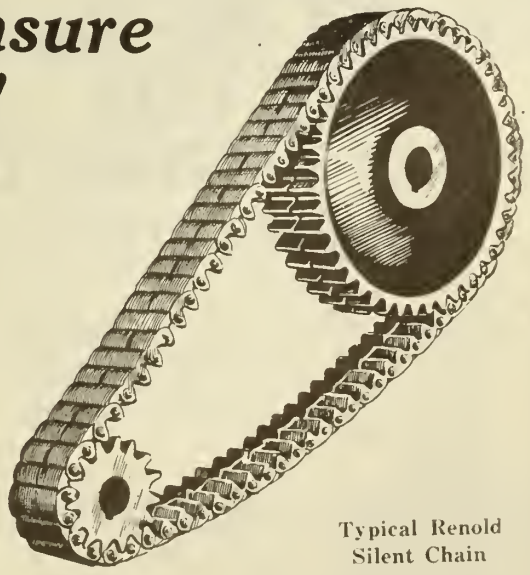
Save Power--and Ensure Greater Production!

RENOLD DRIVING CHAINS—

(1) Have a maintained efficiency of 98.2%.
(2) Save power.
(3) Ensure maximum production.
(4) Run SLACK between shaft centres, thereby eliminating bearing friction and reducing maintenance costs.
(5) Are not affected by heat, cold or moisture.
(6) Require little or no attention when once installed, etc.

Our ENGINEERING SERVICE is entirely at your disposal.

Write for Bulletin 200|5c, "Notes on the Selection of Chain Gear."

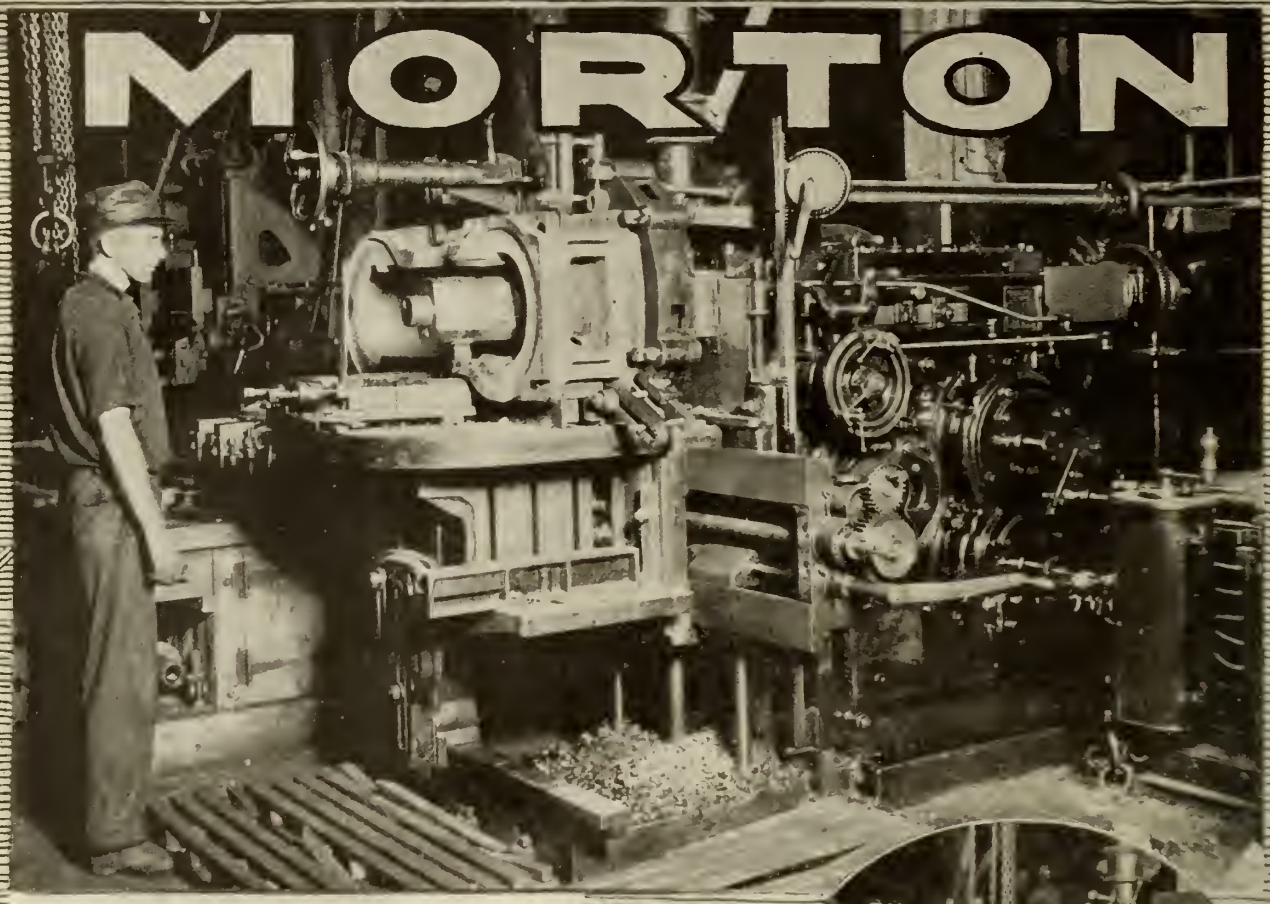


Typical Renold Silent Chain Drive

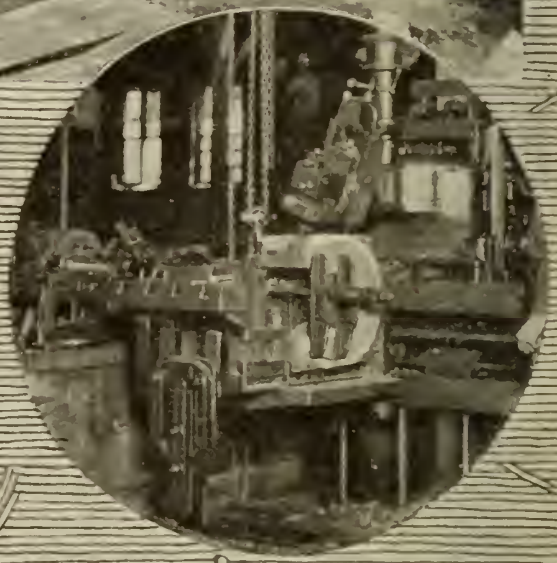
HANS RENOLD OF CANADA, Limited
11 St. Sacrament Street, MONTREAL

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MORTON



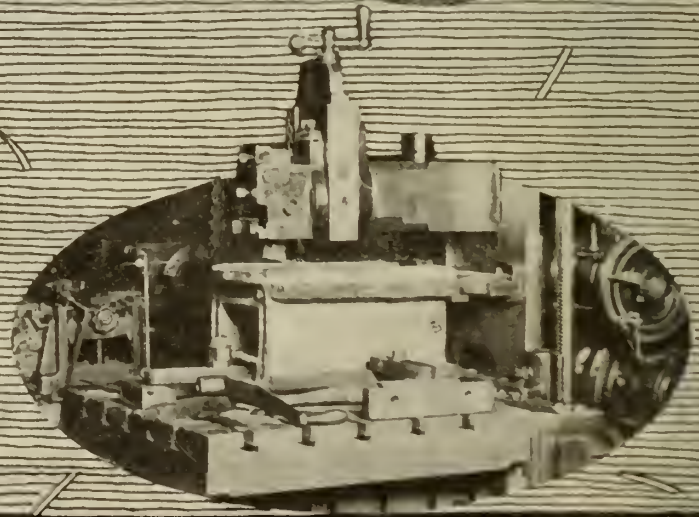
Increased Driving Box Repairs Forced the Purchase of this Morton Draw Cut Shaper



Delays to output were traced direct to driving box repairs in this busy shop. Time element and shortage of man power were considered and the installation of this "Morton" reflects the good judgment of these thoughtful officials to install machines of guaranteed production power.

This Morton handles all the machine work on driving boxes—planing to thickness, planing shoe and wedge faces and crowning for bearing brass. It simplifies handling and reduces machine time.

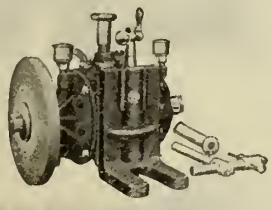
May we send Bulletin A-6 explaining numerous points of merit?



MORTON MFG. CO.

Muskegon Heights - Michigan

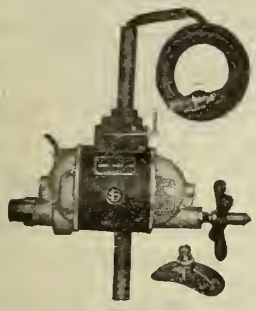
U. S. Electrical Tools



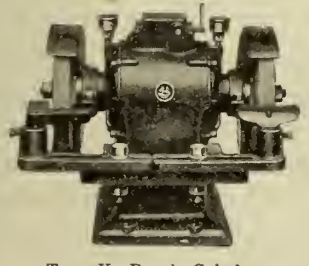
Angle Plate Grinder
4 sizes, ½—1—2 and 3 H.P.
Wheels 8 to 14 in.



Type R. Center Grinder
Wheel 6 x ⅜ x ½ in.



Three Sizes.
¾ in.—1 in.—1¼ in.
Drills these sizes in. holes in steel.

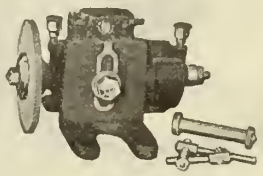


Type K. Bench Grinder
4 sizes, ¼—½—1—2 H.P.
Wheels 6 to 10 in.

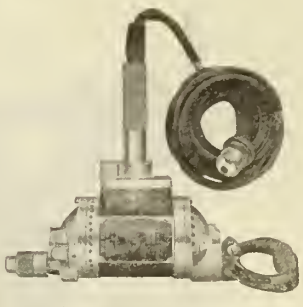


Come 'round and meet the Family

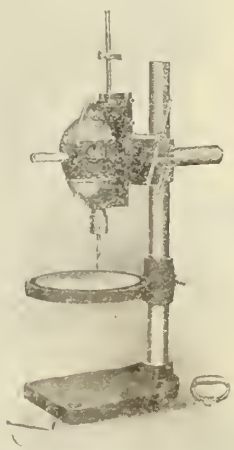
These are just a selection of U.S. Electrical Tools starting with the "daddy" of them, the famous U.S. Floor Grinder, self-contained and like all U.S. Tools only waiting to be coupled up to the "juice" so that it can start work at once. There are many other members of the "family." Get one of our catalogs and make their acquaintance. It will pay you.



Type HB. Center Grinder
with Angle Plate.



Universal Motor Drill
For either A.C. or D.C.
3-16" and ¼" capacity in metal.



Combination Hand and Bench Drill.

The United States Electrical Tool Company

8th and Burns Street - - Cincinnati, Ohio

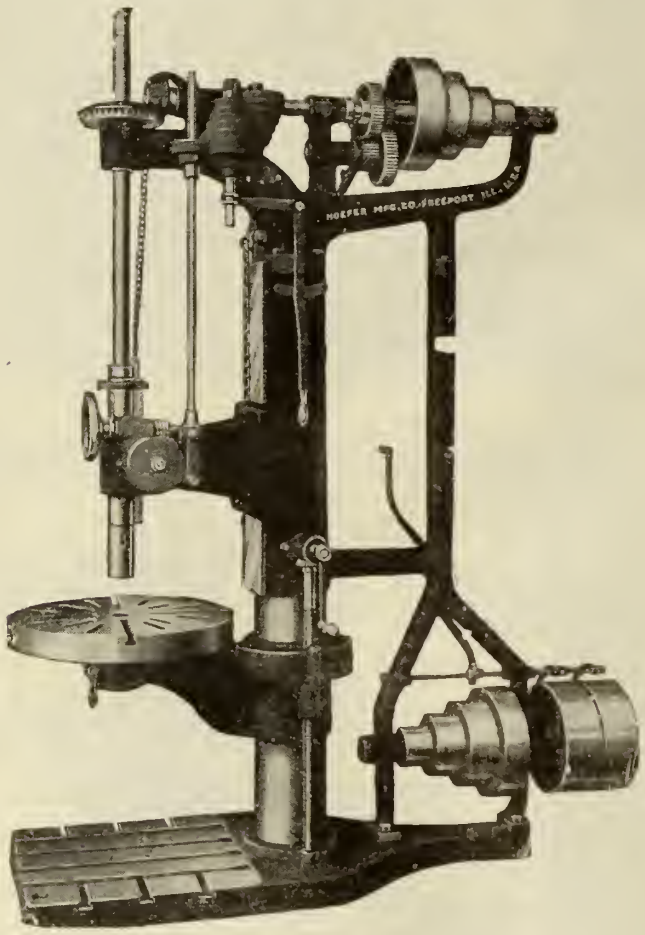
For Sale by The Canadian Fairbanks-Morse Company Limited

FAIRBANKS-MORSE QUALITY F M 100%

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HOEFER

the Driller sold by shopmen



You can talk on an equal footing with a Hoefer Sales Engineer. For he's been all through the very same mill that you are grinding—he's struggled with the problems of planning his production the quickest, best and most economical way, and the harder problem of making performance match promise, and he fully appreciates the importance of selecting equipment that will prove the most suitable to handle a particular set of conditions. So he knows just what you're up against, is qualified to be of real assistance to you and is always ready to apply his own shop experience to help you over a rough spot or two.

We think it a mighty fine combination—Hoefer Drillers and Hoefer Sales Engineers. Drop a line today to the nearest sales office and let a Hoefer engineer prove to your own satisfaction how helpful Hoefer Service and Hoefer Drillers can be to you.

Send for the Hoefer Catalog

HOEFER MFG. CO., FREEPORT, ILL.

Sales Engineers for Hoefer Heads: Chicago, 621 Washington Blvd.; New York, 30 Church St.; Philadelphia, Bourse Bldg.; Buffalo, Ellicott Square Bldg.; Cleveland, Citizens' Bldg.; Pittsburgh, Empire Bldg.; Detroit, 602 Kerr Bldg; Milwaukee, Majestic Bldg.; Dayton, John M. Howett, 12 W. Second St.; St. Louis, Colcord-Wright Machinery & Supply Co.; Minneapolis, F. E. Satterlee Co.; Montreal, Canadian Fairbanks-Morse Co. (head office).

Sales Offices for Hoefer Drillers: Boston, Factory & Mill Supply Co.; Providence, Brownell Machinery Co.; New York, F. H. Niles & Co., Woolworth Bldg.; Philadelphia, Luster Machinery Co., 917 Arch Street; Baltimore, Aumen Machinery Co., 107 E. Lombard Street; Syracuse, C. H. Wood Co.; Rochester, and Buffalo, Ogden R. Adams; Pittsburgh, Motch & Merryweather Machinery Co.; Cleveland, Cleveland Tool & Supply Co.; Dayton, John M. Howett, 12 W. Second St.; Detroit, Cadillac Tool Co.; Indianapolis, A. D. Heath Machinery Company, Merchants Bank Bldg.; Chicago, Federal Machinery Sales Co., 12 N. Jefferson St.; Milwaukee, Badger-Packard Machinery Co.; Minneapolis, F. E. Satterlee Co.; St. Louis, Colcord-Wright Machinery & Supply Co.; Atlanta, Walraven Co.; Birmingham, Young & Vann Co.; New Orleans, Oliver H. Van Horn Co.; Seattle, Portland, Ore., San Francisco, Los Angeles, Eccles & Smith Co.; Montreal, Canadian Fairbanks-Morse Company (head office), for all Canada.

Selecting Wheels for "Off-Hand" Grinding

Part only of a treatise on "Grinding Wheel Selection," by Carl F. Dietz, General Sales Manager of Norton Company.

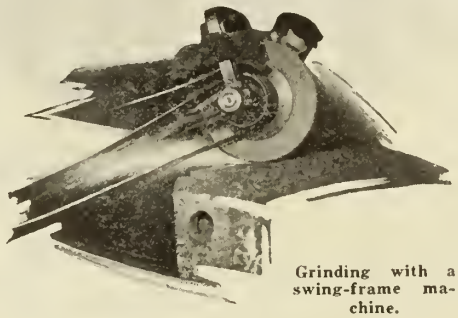
OFF-HAND grinding includes all sorts of rough grinding on castings or other parts where precision is not required, but where the quick removal of metal is the primary object. It also includes certain kinds of tool grinding which depend on the skill of the operator, but is usually confined



Off-hand grinding on a floor stand.

to the rougher tools for lathes and planers. There are three types of machines employed: Floor and bench stands, swing frame, and flexible shaft machines. Obviously the floor stand, being generally the most rigid of these types, may for certain operations be fitted with comparatively soft wheels. For various kinds of tool grinding or light general work, grades M to P can well be employed, while for heavy castings such as journal boxes and the like, or very sharp work, grades as hard as U are necessary.

Swing frame machines are subject to much vibration, due to their light construction and also to the manner of application. In grinding with swing frame machines the wheels are generally subject to much abuse, being brought down upon the casting with much force. Vibrations transmitted as a rapidly intermittent series of shocks at the wheel face can readily be seen to exercise a destructive influence on the structure. Grain particles are split off before they have performed their measure of



Grinding with a swing-frame machine.

work unless they are firmly held; hence, harder grades must be selected.

The flexible shaft machine is not much used, but finds application where the parts to be ground are clumsy and have corners or recesses that can only be reached by having a wheel so mounted that it can be presented to the work by the operator at will. Bath tubs, sinks, certain railway castings, and the



Flexible shaft equipped with Norton wheel.

like are ground in this manner. Obviously with little to support and only the hand of the operator to guide or steady it, the wheel has to overcome the shocks resulting from the many irregularities of surface ground and therefore needs to be of hard grade.

NORTON COMPANY OF CANADA
HAMILTON, ONTARIO

Electric Furnace Plants:
Niagara Falls, N.Y.
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Canadian Agents:
The Canadian Fairbanks-Morse Co., Ltd., Montreal, Toronto, Ottawa, St. John, N.B.; Winnipeg, Calgary, Saskatoon, Vancouver, Victoria.
F. H. Andrews & Son, Quebec, Que.
Simonds Canada Saw Co., Vancouver, B.C.

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For Sale by The Canadian Fairbanks-Morse Company Limited

FAIRBANKS-MORSE QUALITY F M 100%

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Tool Steel

— FOR EVERY PURPOSE —

The Product of
Over 100 Years' Experience

NICHOLSON'S

MOWBRAY

MADE IN SHEFFIELD

"Aqua Mowbray" Triple High Speed Steel
Absolutely uniform in quality. For all heavy duty lathe, slotting, drilling, and milling tools, etc.

"Mowbray" Double Extra Crucible Cast Steel
For dies, taps, drills, reamers, heavy shear blades, etc.

"Mowbray" Extra Crucible Cast Steel
for common dies, blacksmiths' sets, chisels, etc.

Crucible Steel Sheets for General Purposes

Full range of sizes carried in stock

BAINES & DAVID LIMITED

Iron and Steel Merchants

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TORONTO

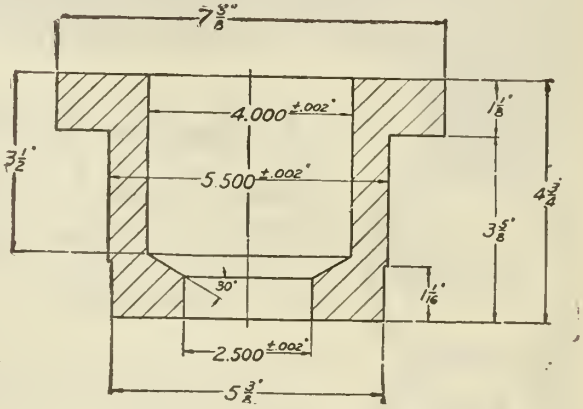
Steel Yards
Eastern Harbor Terminal

GISHOLT

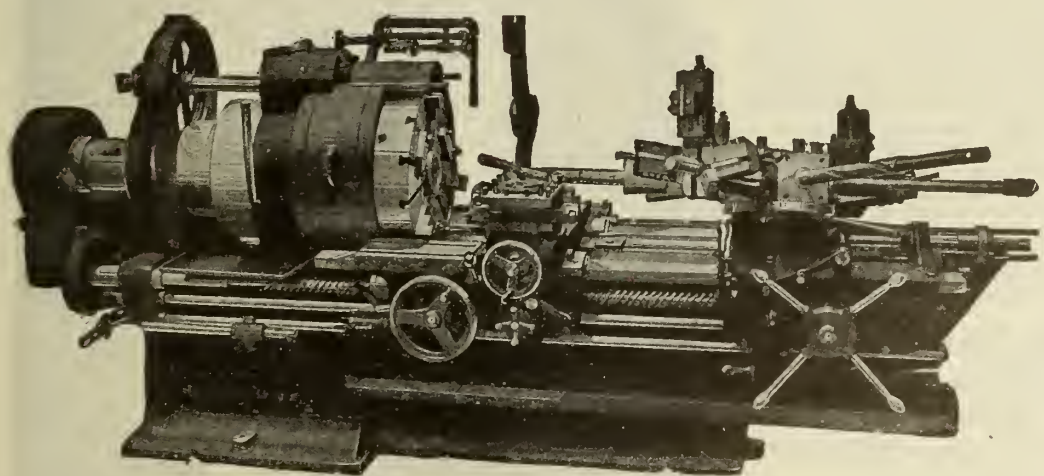


11 Minutes

(Stuffing Box Gland of Cast Iron)



Savings on Regular Run of Work



It is the consistent savings made on your *regular run of work* that count.

The piece shown above was selected with this fact in mind. It is representative of the hundreds of other jobs which are daily being handled on Gisholt Standard Turret Lathes with Standard Tools.

Do you see the point? Gisholt Lathes do not have to depend on the exceptional job to make their installation profitable. Savings in time are made on your regular run of work. Their economy is spread out over a large area.

Why not find out what these savings are on the work you are doing? Gisholt salesmen are trained to give you this information.

GISHOLT MACHINE CO., 1207 East Washington Ave. MADISON, WIS., U. S. A.

Builders of Standard and Automatic Turret Lathes, Vertical and Horizontal Boring Mills, Tool Grinders, Small Tools, Special Machinery, etc.

Eastern Sales Office: 30 Church St., New York *Works:* Madison, Wis., Warren, Pa.

Canadian Agents: The Canadian Fairbanks-Morse Co., Ltd., St. John, Quebec, Montreal Ottawa, Toronto, Hamilton, Windsor, Winnipeg, Saskatoon, Calgary, Vancouver, Victoria

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15 Sales Offices Backed by the 100% Standard of Quality

THE Canadian Fairbanks-Morse Company Limited reaches out to you through its sales houses and offers the service and satisfaction that is assured by its 100% standard of quality and service.

To be able to turn to an institution that dominates its field in the industrial world is to safeguard the character of the merchandise you buy. To deal with an organizationthat is doing business at your very door puts upon the man you know that "responsibility which is the conscience of business."

Every one of these 15 offices has been established to bring to you the full advantages and benefit that have made The Canadian Fairbanks-Morse Co. Limited a national institution. Here in these offices is offered everything mechanical that your business requires — they centralize your purchasing—group your orders—bulk your shipments and send but one invoice. And when you buy from The Canadian Fairbanks-Morse Co. Limited you are guaranteed the 100% standard of quality and service in product and organization.

Make our nearest office your buying centre—our catalogue is your buying guide —our 100% quality seal your guarantee.

The Canadian Fairbanks-Morse Co., Limited

Canada's Departmental House for Mechanical Goods

Halifax St. John Quebec Montreal
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2

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXIV. No. 27 December 30, 1920

1921 Finds Canadian Business Sound

THE words deflation of values and readjustment are so threadbare from overwork that they have lost their power to convey the meaning they should express.

Our best business men saw readjustment coming as soon as the war was over. Steps were taken then to fight it off—to continue our fake prosperity—and these were successful to a much greater degree than the most ardent exponents of that system ever thought possible.

Nothing cracked following the war.

We continued to imagine that our dollar was one hundred cents, and not merely a medium of exchange, depending for its value on the selling price of commodities.

The deluge of war work brought with it habits of waste—an unbalanced organization with all stress on production and none at all on selling—a government ready to take the product and assist in financing its production led to a neglect of scientific market surveys and study.

Men and women from all trades and callings went to war shops and earned more money than they ever thought possible. They acquired habits of extravagance in living and lavishness in spending that read like new ventures of the prodigal son.

In plain, honest words—we were not ready to settle down after the war, and the volume of business that has passed since then has too often lacked the sincerity that springs from intrinsic value and the stability that can be secured only from sound basic conditions.

Readjustment is bound to hurt. It would be against all business and physical laws were it otherwise.

It means passing from an atmosphere of imaginary prosperity down to an era of common sense.

It means that earnings must be less, where there was war inflation—it means that competition is again taking its old place in the business world, and that sales will more and more rest, not upon emergency or undue haste, but upon mechanical excellence and administrative sincerity.

Labor efficiency is increasing, but the lamentable, grotesque feature is that the improvement comes when the demand for production has fallen off.

There has been progress made in killing the strike germ.

Workmen seem slow to realize what a costly weapon the strike has been to labor. It has not been a boom, but a boomerang.

The year 1921 will require patience and consideration from employers and employees. It would be a wonderful thing were the labor agitator and the autocratic employer to link arms and depart from the industrial district. Their absence would be of more assistance than their presence and interference.

Fundamentally Canadian business is sound, and becoming schooled to changed conditions. Financial restrictions have caused firms to cut off the frills and clean their houses, and they have put them in shape for healthy growth and certain expansion.

Scores of splendid American firms have decided on their location in Canada, and from here will cater to the great markets of the Empire.

The development of the Canadian West is going on on a more sane basis than ever before. The people there realize that their future rests in working the soil instead of the people. This means more implements. More implements means more machine tools, iron, steel and equipment.

The year 1921 is before you, and it comes a day at a time. If you think there's a greater or a better land than Canada, or a place where you will be better treated, make haste and locate—if you believe that this great Canada is your best chance, then help make it what you want it to be.

Tracing the *Development* of the Year

Canadian Cities Have Prospered, and, in Spite of High Costs, Extensions Have Been Made—Many U. S. Firms Getting Ready To Open Up New Branches in Canada During the Year 1921.

CALGARY HAS HAD A BUSY YEAR

Reports Say That Business Has Been Good In All Lines—Work Still On in the Oil Fields in That District

By J. H. HANNA, Secretary Calgary Board of Trade

CALGARY.—During the past year Calgary has enjoyed increasing prosperity and this is shown in the bank clearings, which for the first ten months of the year were $348,549,415, as compared with $269,839,671 for 1919, an increase of $78,709,744. The live stock industry is one of the important branches of Calgary's trade and during the past year the Alberta Stock Yards Company have spent $400,000 in improvements and additions to the yards and for new offices. They have also secured an additional sixty acres of land in order to increase their facilities, and provide for the rapidly growing business.

Notwithstanding the comparative high cost of building, considerable work has been done and the building permits for the first ten months of the year show a total of $2,532,200, an increase of $411,200 over the previous year. At the present time two large and modern picture theatres are under construction and will doubtless be completed in the course of the next couple of months.

In order to keep pace with the increasing population, it has been necessary for the School Board to build five new schools, and even that extra accommodation has not been quite sufficient to meet the need.

Calgary has also benefited by the increased output of coal in this part of the Province, most of the leading coal mining companies having their head offices in this city. In the Drumheller district particularly, there has been a greatly increased optput of coal, due to the new markets obtained in Manitoba and Saskatchewan. There is every prospect that this trade will develop, in view of the tests which have been made and which have proved satisfactory. This will mean a greatly increased output for the Alberta mines in future.

Calgary's principal industries, including packing house products, flour, breakfast foods, soap, saddlery, and other commodities, also the large shops of the C. P. R., have been kept busy during the year, although latterly, owing to the readjustment in prices which is now going on, business is not quite as active as in the earlier part of the year.

Development work is still going on in the oil fields adjacent to the city, and operators are hopeful of finding further oil deposits in the near future.

ST. JOHN HAS MORE POWER NOW

Existing Plants Have Been Much Enlarged, And Shipping Facilities Are Being Improved for Ocean Ports

By R. E. ARMSTRONG, Secretary St. John Board of Trade

ST. JOHN, N.B.—Marked progress has been made along one important line of industrial activity on this locality during the past year, viz., the dry dock and port development at Courtenay Bay, East St. John. The chief purposes of this development are to provide St. John with additional port facilities, supply it with one of the largest dry docks in the world, and at the same time furnish the Canadian National Railways with adequate terminals. The C. N. R. has had for many years track connection with the western side of Courtenay Bay and recently the eastern side has been connected with the main line of the C. N. R. by means of a spur track. The inner basin of the bay is being dredged out to conform to the depth of the main harbor which lies westward of the peninsula upon which the city proper stands.

Adjacent to Courtenay Bay, further industrial promotion is about to be developed, including the establishment of a mill for the manufacture of fibre cases and also a pulp mill. These industrial works will be established by a corporation, of which the principals are the Clarke Bros. firm of Bear River, N.S.

The pulp mill of the Nashwaak Pulp and Paper Company, located alongside the reversing falls, just above the main harbor, has been enlarging its capacity lately and has arranged for an added water supply from the city to cover its new development programme.

Immediately adjacent to this mill the Canadian Pacific Railway is engaged in the construction of a steel bridge across the Falls. The piers for the bridge are well advanced and the placing of the metal work will be begun within the next few months.

The lime industry of St. John has made excellent progress this year. The plant of the Provincial Lime Company, which was destroyed by fire some months ago, has been rebuilt and enlarged, and adjacent to it the Provincial Government has an agricultural lime industry at work.

The lumber industry, insofar as the overseas trade is concerned, has been quiet this year, chiefly because of the unsettled conditions in the Mother Country. Large quantities of lumber are piled up here, awaiting an improvement in the market conditions. A somewhat better state of affairs prevails in the United States lumber market. The shipments of lumber to the United States during the first nine months of 1920 amounted to $3,737,992, as compared with $1,506,897, for the same period of 1919. The entire lumber export to the United States last year from this district was valued at $2,504,798. Almost all the lumber mills are now closed down for the season. It is not expected that there will be a large lumber cut this winter.

There have been a few changes in the metal industries. The Portland Rolling Mills plant on the Strait Shore has lately changed hands, and the company now operating it is known as the New Brunswick Rolling Mills. A number of lines of iron and steel products are being manufactured by this Company.

The foundry on Courtenay Street, known as the Smith Foundry, has been acquired by the firm of Harrigan and Howard, who are operating it as the Courtenay Iron and Brass Works.

The McAvity foundry plant on the Marsh Road is not yet operating to capacity, but the city plants of this energetic firm are very busy.

The Maritime Nail plant, the Pender Nail Works and the Canada Nail and Wire Company have been fairly busy throughout the year.

There has been a merger of the edge tool works formerly operated by Wilfred Campbell & Son and Josiah Fowler Co., Ltd. The new corporation operates under the firm title of Campbell & Fowler.

The brush and broom factory of T. S. Simms Co., Ltd., has been operating to full capacity, necessitating some important additions to the plant. The Simms plant is one of the best in Canada.. The factory of the Canada Brush Company has also had a good season's work and

some improvements are being outlined for the coming season.

The year has been a quiet one among the fish industries, due to scarcity of fish and disturbed market conditions. The sardine plant of the Booth Fisheries Company, of Canada, has not opened at all this year. The Connors Bros. sardine factory had a fairly good season, but with most of the fish plants the season has been a far from satisfactory one.

One of the largest of the city's industrial plants—the Atlantic Sugar Refinery—has been one of the greatest sufferers from the sudden drop in sugar prices. This factory had been doing a capacity business until a few months ago and had found it necessary to expend a quarter of a million dollars or more in additions and improvements to its storage facilities. The suspension of its business a few weeks ago has not only forced hundreds of men out of employment, but it has also greatly added to the storage troubles of the Company. In addition to its own warehouses being filled with raw sugar, several city warehouses on the water front are crowded with the raw article. It is expected that the refinery will resume operations about the first of January.

The port industrial workers have not been overworked this season and, unless an improvement in the overseas markets occurs very quickly, the amount of freight passing through the port will not be as large as usual. The shipments of lumber and general cargo threaten to be light this winter. The shipping merchants are optimistic and are hoping for better things by the first of the year.

Since last winter an additional grain conveyor, in connection with the C.P.R. grain elevator, has been placed on one of the west side piers.

One of the most encouraging features of the industrial outlook in this vicinity is the development of Hydro-Electric power, which has just been begun under provincial auspices on the Musquash River, 12 miles from St. John. From this one source about 8,000 horsepower will be developed for industrial and general use in the city. With cheaper power added to the export possibilities and distributing advantages of St. John, the industrial outlook is most encouraging.

In closing, a word or two concerning city industrial development. This year, for the first time since the close of the war, the city has been indulging in an extended programme of street paving, killing two birds with one stone—beautifying the city and at the same time furnishing employment for returned soldiers and others out of work. The programme will be revived in the spring. It is intended during this winter to indulge in some road extensions at the farther end of the city, adjacent to the Kennebecasis river, where the city owns a beautiful natural park that was bequeathed to it by a former federal member, Colonel Tucker. The city also proposes to do a lot of stone crushing this winter to help out next season's street programme.

THREE RIVERS HAS NEW PLANTS

Big Building Programme is Being Finished—An Active Board of Trade is Working on Several Schemes There Now

By WILLIAM TROTHIER, Assistant Field Secretary Three Rivers Board of Trade

THREE RIVERS, QUEBEC.—Three Rivers, in the Province of Quebec has, this year, more than maintained its rapid growth of the last ten years.

Industrially it has taken a long step forward, with the coming of a new plant, the Three Rivers Pulp and Paper Co. The capitalization of this latter company is set at $4,400,000. It has contracted for a plant costing a million and a half, which, when completed, will employ approximately 5,000 men and have a capacity of 200 tons daily.

Three plants, the Canada Iron Foundry, the Wayagamack Paper Co. and the St. Maurice Paper Co. have opened club-houses for the workmen, showing a healthy development of the spirit of brotherhood between capital and labor.

Few strikes have disturbed the industry field. Wages are moderate, the workers satisfied.

The problems that affect the city, such as a good water supply, housing, a new station and new transportation facilities to meet the growing demands of business, are all on the coming year's program of the reorganized Board of Trade, which starts the new year with a revenue from memberships exceeding anything it has had in its history.

Plans ready for the building of the million and a half dollar plant of the Three Rivers Pulp and Paper Co., capital, $4,400,000. Capacity, 200 tons per day; employs 5,000 hands.

Plans ready for a million dollar addition to the Wabasso Cotton Co., making increase of $200,000 in payroll.

Tidewater Ship Co. notes big increase in business.

Mechanical Engineering Co. buys 365,000 feet of land for expansion purposes.

St. Maurice Lumber Co. completing new mill for paper manufacture. Will be ready to manufacture pulp in the spring. Will probably require 5,000 hands in new venture. This company has also spent $50,000 in the construction of homes for workmen.

The Canadian Consolidated Rubber Co. has opened a branch in this city.

A steel concern is negotiating with the city for a plant in Three Rivers.

Other developments indirectly affecting the industrial progress of the city is the building of a bridge at Batiscan, which will greatly facilitate transportation here, and the opening of industrial classes for workmen.

NEW INDUSTRIES IN WOODSTOCK

And a Very Large Number of the Men in Factories Own Their Own Homes—Look for a Good Year

By HARRY SYKES, Secretary Woodstock Board of Trade

WOODSTOCK, ONT.—Woodstock has experienced a busy year in almost all lines of industry. A review of the labor situation in Woodstock reveals the pleasing fact that there is little unemployment in the city at the present time. While some of the local factories have reduced their working hours during this month, none of them have closed down, and only a small proportion have reduced their staff to any extent. A large programme of city improvements is under way, which is helping materially to solve the labor problem and the volume of work thus made available appears to be nearly equal to the demand.

Twenty-three principal industries represent a total investment of $4,430,000. The output of these industries during the past twelve months was $8,418,000. The annual payroll amounts to $1,797,000. It is a matter of congratulation to the factory employees that 534 own thei own homes, which are valued at $720,000.

During the past year a Canadian Branch of the De Long Hook and Eye Company was established here. Also the Kennedy Car Liner and Bag Company purchased the William Stone Company factory. The newly organized Karn Piano Company commenced operations in the Karn Factory. A few days ago arrangements were completed with the American Ironing Machine Company, Chicago, to establish their Canadian branch in Woodstock. They anticipate operating their plant here about March 1st, and will make Woodstock their head office for Canada.

The heads of industries are quite optimistic as to the future, and are looking forward to the factories being busy as usual in a short time.

ST. THOMAS' INDUSTRIAL ERA

Plan to Buy Tract of Land for Firms That are Likely to Come—Several New Ones Came in 1920

By J. L. LODGE, Secretary St. Thomas Board of Trade

ST. THOMAS, ONT.—The Thos. A. Edison, Inc., have purchased the plant and buildings of the St. Thomas Cabinets Limited, comprising about one hundred thousand feet floor space, to which they will add two large wings next year, and this company, which will be known as the Canadian Edison Phonographs, Limited, will begin operations about the first of the year.

Hutch Bros., of Canada, manufacturers of wooden vehicle toys, and the Universal wallpaper hanger, and the Provincial Machine and Supply Co., manufacturers of phonograph hardware, were incorporated about the first of the year, and are now both under production.

The E. T. Wright Co., manufacturers of "Just Wright" shoes have disposed of their plant and business to the Talbot Shoe Co., Limited.

The Canada Iron Foundries have spent $150,000.00 in extending their plant this year, and anticipate further extensions in 1921.

Early in January the citizens will vote on a by-law providing for the purchase of 75 acres in the east end of the city for the purpose of an industrial area. The proposed area is bounded by the Michigan Central, Canadian Pacific, Wabash, and Grand Trunk Railways.

KITCHENER CONTINUES TO GROW

There Are Now 123 Industries With a Payroll Of $11,000,000—Large Extensions Made to Factories

By E. J. PAYSON, Secretary Kitchener Board of Trade

KITCHENER, ONT.—Kitchener continued during 1920 to experience a steady expansion and prosperity of established industries. Population increased by 1,975, and in the city proper there are now 23,027 people. Assessable property increased by $3,265,344, and now stands at $18,053,251. There are 123 industrial establishments in the city, giving profitable and steady employment to some 8,000 employees, who receive about $11,000,000 in wages. The aggregate output of manufactured goods last year was approximately $40,000,000.

Among the larger additions to industrial plants is that of the Lang Tanning Company, Limited, who are spending about $200,000 on buildings and equipment. The Kaufman Rubber Company, Limited, has under erection a five story addition to its big factory, which addition would make a substantial industry of itself. The Dominion Tire Company, Limited, has erected building and equipment the present year which, when completed, will have cost nearly half a million dollars, and their daily output of automobile tires and allied products has reached mammoth proportions.

The Ames-Holden McCready System completed this year the automobile tire factory begun late last year, and will shortly have reached the quantity production stage in that line. This firm has built and equipped this year a factory for the production of felt footwear, which is running to capacity. They also have begun to manufacture rubber footwear in premises in their tire factory not yet occupied by that industry. This trio of industries under the A.H.M. control form a big and valuable addition to Kitchener's manufacturing interests.

Salts & Potash, Limited, have doubled the space and capacity of their plant and are approximating the dimensions of a large and important industry. Their products consist of salts, potash, chlorides and other chemical products.

To cope with the increased demand for electrical power the Light Commissioner has erected a modern equipped sub-station in the industrial centre of the city. Transportation has been improved by the construction by the C.P.R. of a special freight line entering the city at the east end as a continuation of the Grand River Railway, which is the electrically operated branch of the C.P.R. between here and Port Dover, on Lake Erie.

The addition to Victoria school was completed and occupied this year and at present a big extension is being erected to the King Edward school, and a wholly new school is being built in the South Ward.

This year has also seen the building and equipment of a Nurses' Home for Victoria Hospital, built, furnished and presented to the hospital by the late Jacob Kaufman and family.

BRANDON GETS BIG CONCERNS

Gaining in Importance As a Distributing Centre—They Look for Many More In Coming Years

By H. L. CRAWFORD, Brandon Board of Trade

BRANDON, MAN.—Brandon's importance as a distributing centre is being recognized more and more each year. The number of large concerns locating here established a record during 1920, that has not been equalled since the palmiest days before the Great War.

Some of the really large concerns that have now located here are the Massey-Harris Company, Limited, and the Imperial Oil Company. The Massey-Harris people bought the Gordon Mackay building for $130,000, and will establish a large distributing plant for Western Canada here.

The Imperial Oil Company has commenced operations to erect a $350,000 plant here, and their offices are already established in the city. The L. R. Steel Company has recently made a purchase of a large business in this city, and will open up January 1st. It is also stated that the Grain Growers Limited will place a large plant here for distribution purposes in the West. Several other smaller concerns have located here during the year, and the prospects for a large number of manufacturing plants coming here in 1921 are very bright.

CHATHAM SECURED TWO IN 1920

Industries Have Been Well Employed and Plans Are Being Made for Full Operations in Short Time

By M. M. MAXWELL, Manager Chatham Chamber of Commerce

CHATHAM, ONT.—During the year 1920, Chatham has located two industries, one of which moved here from another town, and the other, a new Canadian corporation, in which American interests are largely concerned. The first company is making knit goods, while the latter is putting on the market a new furnace, modelled after a very popular and wide selling furnace in United States. Locally, conditions have been very good during the year, and the majority of concerns have extended their businesses considerably.

The Hayes Wheel Co. are extending their rear axle assembly department, as well as their truck wheel section; the Canadian Fertilizer Co. have added quite an extensive addition to their building, making commercial fertilizer; the Gray Dort Motors Ltd., have added a large plant, in which they have installed extensive and modern machinery for making some of the parts which originally were made in other plants, particularly the pressed steel parts; the Libby, McNeil & Libby Co., canners and packers, have added to their buildings during the year, while the Canadian Des Moines Steel Co., making structural steel and tanks, have a considerable addition under way; the Chatham Malleable and Steel Co. is constructing a building which practically doubles their capacity

and installing their late, modern machinery for the manufacture of automobile accessories.

Other industries in the city are doing some small extension work, while in one or two cases considerable expansion is now planned, but actual construction work has not been undertaken and will not be for a few weeks or possibly six months.

The city of Chatham has not experienced as much of a commercial and industrial slump as has been experienced in many cities, because of the varied nature of the industries located here. There are very few idle men at the present time, even when other cities are experiencing considerable difficulty in this particular connection. Two plants in the city have been running small force for some weeks, but both are now making preparations for reopening their plant to full capacity by the first of the year at the latest.

BIG PLANTS PUT UP IN OSHAWA

General Motors Added to Their Plant—Several Large Buildings in the Course of Construction

By J. A. McGIBBON, Secretary Oshawa Board of Trade

OSHAWA, ONT.—During the past year Oshawa has made wonderful steps in industrial development. General Motors have added considerably to their plant, which now includes the Oldsmobile Motor Co., in addition to the McLaughlin and Chevrolet plants and the Samson Tractor. Pedlar People have moved into their spacious new plant, one of the finest in the province. W. J. Trich & Co. are rebuilding their planing mill and woodworking factory.

The Moffatt Motor Sales have erected a fine new showroom for the display of their Oldsmobile cars. The new Theatre Paramount has opened a fine, up-to-date structure seating 1,100 people. L. R. Steel & Co. will move into their new store in a few days. Ward & Dewland, dry goods merchants, are moving into a fine new store erected by Bradley Brothers. A 65-acre park was given to the town this year by General Motors Ltd.

WINNIPEG IS GROWING RAPIDLY

Building of Factories and Shops Calls for Expenditure of Many Millions—More Power to be Available

By J. M. DAVIDSON, Winnipeg Board of Trade

WINNIPEG.—The year 1920 has seen substantial progress in the city of Winnipeg. Building figures for the year will run close to eight and a half million dollars. Not only is this the largest total since 1915, but it equals the combined figures of 1917, 1918 and 1919. Winnipeg's building totals for the first nine months of 1920 were equal to the combined totals of twenty other Canadian cities. Three large motion picture theatres have been erected in Winnipeg during the year, and operations have just been commenced on a six story addition to the Opympia Hotel.

Bank clearings have shown a remarkable increase during the year. For a single week ending November 10th, clearings reached the enormous total of $110,806,-325.00. This is not only the highest weekly figure ever reached in the Winnipeg clearing house, but it actually exceeded the clearings of the City of Toronto of two weeks previous.

The total capitalization of new companies established in the Province of Manitoba has already exceeded one hundred million dollars. Some of the larger industries established in Winnipeg during the year are: The Canadian Community Cut Glass Co.; Red River Pulp & Paper Co.; Western Film Mfg. Co.; Orange Crush Bottling Co., soft drinks; Tractioneer's Ltd., farm implements; Western Suit Case Mfg. Co.; Canada Fibre Products Co., hemp products; Winnipeg Motor Cars Ltd., automobile manufacturers; Picardy Candy Shops, Ltd.; Crown Broom Mfg. Co.; Martin's Limited, clothing manufacturers; Campbell Mfg. Co., clothing manufacturers.

The Winnipeg River Power Company, a subsidiary of the Winnipeg Electric Railway Co., has worked during the year on the first unit of a $10,000,000 power plant on the Winnipeg river.

U. S. PLANTS IN STRATFORD

Two Have Started and Already Have Secured Production—Employment For Many More Hands is Provided

By A. W. DEACON, Secretary Stratford Chamber of Commerce

STRATFORD—In the past year the Canadian Edison Appliance Co., Ltd., and the Gerlach-Barklow Co., Ltd., both American plants, opened up Canadian branches in this city. The former manufacture all sorts of electrical appliances and is employing approximately three hundred hands. The Gerlach-Barklow Co., Ltd., manufacture high-class art calendars.

The Kindel Bed Co., Ltd., which opened its Canadian branch in Stratford about two years ago, have, during the past few months, largely increased their plant. The Grosch Felt Shoe Co. have commenced operations during the past year, manufacturing felt shoes and are now employing approximately seventy-five hands.

NEW PLATE MILL AT SYDNEY

Development of the Steel Mill Has Been Carried On—Making Several More of Its Own Products Now

By F. C. KIMBER, Secretary Sydney Board of Trade

SYDNEY, N.S.—In February, 1920, the new 110″ plate rolling mill of the Dominion Steel Co. was placed in operation. This new department involved an expenditure of approximately $5,000,000 and has a capacity of approximately 12,000 gross tons monthly of sheared plates up to 98″ in width. Since the beginning of operations it has been shipping its entire production to the Canadian Government, with which the company has a contract for from 50,000 to 75,000 tons of plates per year for five years. In the early part of the year the first two units were placed in operation in the company's new power house, which has been erected at a cost of $1,250,000 and which, when completed early next year, will have a maximum capacity of approximately 10,000 W.W. This additional power will permit the electrification of some of the producing departments that have heretofore been using steam, and will enable the company to produce its electric power requirements at the lowest possible cost per K.W.H.

About two years ago the company completed an installation of 120 latest type Koppers by-product coke ovens with all auxiliary apparatus. This installation proved entirely satisfactory. A contract was let for another two batteries of thirty ovens each, which it is expected will be in operation about March 31st, 1921.

During June, 1920, the new electric drive for the rail mill was placed in operation and it has since given entire satisfaction. This replaces the former expensive drive in this department and the additional electric power required is made possible by the erection of the new power house above referred to.

Prior to the end of the year the company should have in operation its new plant for the production of silica brick. This will have a capacity of about 15,000 9″ straights daily. After experimental stages have passed it should enable the company to discontinue purchasing a large part of its silica brick requirements from Pittsburgh district. The silica rock required in this new department is to be brought from a quarry situated only fourteen miles from the steel works.

During September, 1920, the company reopened an old

plant which had been discontinued some years ago by other parties and commenced the production of cement from blast furnace slag. The resulting product has been found to be quite satisfactory for the company's purposes and this department is now operating at the rate of about three hundred barrels per day.

It is reported that the Cross Fertilizer Co., Ltd., which manufactures fertilizer from the Dominion Steel Co.'s slag, and which has built up a very successful business in this very essential product, is contemplating an extension of its plant and producing capacity in the near future.

BORDER CITIES GET U. S. PLANTS

In Negotiation With Large Number of These—Many Will Come Over as Soon as Building is Reasonable

By F. MACLURE SCLANDERS, Border Chamber of Commerce, Windsor

BORDER CITIES—Ford, Walkerville, Windsor, Sandwich, Ojibway. During the past year thirty-one new industries have located at the Border Cities, so that they now have 206 of such, large and small. During 1919, forty-four new manufacturing concerns came in. Practically all of such industrial development emanates from the United States.

At present, we are negotiating with no fewer than seventy-six American concerns, over a third of which have already intimated their decision to come here whenever conditions are more stable. In addition, we are working upon other eighty-six prospects which are shaping favorably in most cases, but are still in the preliminary stages and not yet in the "live" class which embraces the seventy-six first mentioned.

In view of the foregoing, we have obvious reason for encouragement. As a matter of fact, the truly extraordinary development characteristic of these Border Cities during the past few years is still largely unrecognized or uncomprehended in centres further east. This may be because our development mostly has its source in the United States. At any rate, we at this southernmost corner of Canada are forging ahead in a sense that is literally phenomenal. Ours is not mere development. It is transformation. Within the lifetime of a child now at kindergarten we have simply leaped from the town category into the truly metropolitan. This statement is at once conservative and perfectly safe—for, its truth may be demonstrated by the evidence of one's own eyes. It is visible on every hand; in street after street of new homes; in new factories and business premises of every description, and in a prosperous population which now approaches the 60,000 mark! Indeed, one is vividly reminded of the Western boom period of 1910-12, and of the wondrous strides then made by certain more progressive prairie centres. However, there is one fundamental difference: our progress and expansion are built upon the most solid of all foundations—the location and successful operation of new industries.

It may interest to remark that the growth of our industrial life owed practically nothing to munition or other war work, very little of which was conducted here. Few war orders came our direction. Consequently, we pursued the peaceful tenor of our productive ways; and in the end it is probable that we gained rather than lost, even although there might have been some disappointment at the time. Others got the war orders; and while they were working thereon we were expanding the production of our normal commodities.

As to the situation and outlook, we are conscious of no logical reason for gloom. Rather do we welcome the present lull as the one circumstance absolutely required to restore general conditions to the more nearly normal and thereby stimulate a safer and more substantial business than ever.

In our opinion, prices and production costs are grotesquely hysterical. They are idiotic. They are also impossible. They have killed commerce. At last, people have torn the war bandage from their eyes. No war haze clouds their vision. Things appear at their true value. Buyers are disillusioned. The $35 suit that may now be purchased for $120 appeals as a stupid impertinence. The $35 home which its owner is willing to rent at $80 no longer attracts; the $6,000 which offers at from $17,000 to $20,000 still further accentuates the crass absurdity of the greediest, craziest period in the world's history.

Fortunately, however, the crisis is over; the fever diminishes. The candle of high costs is now brightly burning at both ends. Material costs have already indicated a marked decrease while a remarkable increase characterizes the production of the individual worker. We have now actually entered upon the first real period of readjustment. It took us quite a time to wrestle with the purely preliminary stages thereof. Now we are about to make real progress.

As it is, however, American and other manufacturers flatly state that they won't build factories at the prices of to-day which, in the comparatively near to-morrow, must be much lower. Some of them will come in immediately, provided they can be suitably accommodated in rented, ready-made premises.

The outrageous prices of to-day constitute an almost insuperable obstacle against the further, fullest industrial development of this country. But, whenever such revert to the more nearly normal, all the pent up progress of months will be let loose upon us. Business will be better than ever, in our opinion; because business will then be safer.

We do not look for a violent depression: but rather a swift and comparatively easy reversion to a truer basis. Of course, even such a process involves loss for many. Nevertheless, past years of good business, wonderful business, should place intelligent business men in a position to take their goats along with their sheep.

Upon the whole, we were never more optimistic; and, even while waiting for more normal times, we are doing wonderfully.

BIG THINGS AT PORT ARTHUR

Pulp and Paper Industry is Becoming an Important One—Plenty of Power Available For Use There

By M. FRANCIS, Secretary-Treasurer Port Arthur Board of Trade

RECENT expansions industrially are the inclusion of manufacturing pulp and paper and mining machinery, in the operations of the Port Arthur Shipbuilding Company, Ltd., which will mean an increase of approximately 600 skilled employees, and erecting an open hearth furnace, also the building of the Kaministiquia Pulp & Paper Co., Ltd.'s new pulp mill. It is understood that the local branch of the Provincial Paper Mills, Ltd., is about ready to increase its output to 100 tons pulp and 50 newsprint, per day. Plans for two other pulp and paper mills are about completed.

During the year the Port Arthur Wagon Works has become the property of Jno. Stirrett & Sons, who are expanding into a general woodworking business.

While many manufacturing centres have been hampered by lack of Hydro-Electric energy, Port Arthur is in the fortunate position of having supplies adequate to take care of considerable industrial expansion. The development in the Nipigon river at 72,000 h.p. places Port Arthur in a very enviable position.

The city has set aside for incoming industries 1,000 acres of favorably situated land served by both transcontinental railways and harbor.

Port Arthur is also extremely fortunate in being surrounded with a country that offers unlimited recreational and vocational facilities. These attract each summer many thousands of tourists, 32,000 in 1920, and this is rapidly becoming one of the community's chief industries.

ADDITIONS TO THE GALT SHOPS

C. P. R. Spending Large Amount For New Service There—New Companies Enter The Shoe Manufacturing Field

By H. J. FOSTER, Secretary Galt Board of Trade

GALT.—The industrial development of Galt during 1920 has, on the whole, considering the almost prohibitive building costs, been very satisfactory. Our machine shops, until recent weeks, have been very busy, and a few additions have been made, the R. McDougall Company leading in this respect.

Two new shoe factories, Scroggins Brothers, and the Yale Manufacturing Company, Limited, have been added to the colony, while the Getty & Scott Company, Limited, spread out into two annexes, now having Factories No. 2 and 3.

Among the new firms is that of McCaskey Systems, Limited, in a new building bought by them before removing from Toronto to Galt. In transportation field the outlook is good. At the present time the C. P. R. is engaged in spending its appropriation of $1,000,000 in the city. A new spur line is being built to the heart of the city, the project involving the erection of a downtown station for the Grand River Railway and the Lake Erie & Northern, the company's electric feeders, stretching from Waterloo and Kitchener to Brantford and Port Dover.

GUELPH HAS EIGHT NEW ONES

And Several of the Plants That Are in Operation There are Going to Extend Their Premises in 1921

By H. WESTABY, Secretary Guelph Chamber of Commerce

GUELPH, ONT.—The City of Guelph has made steady progress during 1920. Eight new industries have established themselves in the city, and are as follows:—

Moncrief Furnace & Mfg. Co., the Canadian branch of the Henry Miller Foundry Co., of Cleveland, Ohio.

The Erin Casket Works.

The Guelph Brass Works.

The Federal Electric Washing Machine Co., being the Canadian branch of the Chicago firm.

The Regent Textile Co., from Montreal.

The Sherer-Gillett Co., from Chicago.

The Shinn Mfg. Co., from Niles, Michigan.

The National Standard Co., from Niles, Michigan.

The Moncrief Furnace & Mfg. Co. are to erect a modern foundry building on their property acquired on the York Road. The Erin Casket Works, the Regent Textile Co., the Federal Electric Washing Machine Co. and the Sherer-Gillett Co. have all purchased existing factory buildings, which in nearly every case they have enlarged and improved.

The industries of the city at the present time number 129, and among the improvements made are:—

An addition, three storeys in height, 53 ft. x 90 ft., to the Shinn Mfg. Co.

The Canada Ingot Iron & Culvert Co. are building an entirely new factory building between George and Clarence streets. The plan calls for two buildings, 48 ft. x 290 ft. and 120 ft. x 132 ft.

The International Malleable Iron Co. have completed and are now occupying an addition to their plant of 240 ft. x 260 ft., two storeys in height, and in addition to this they have just acquired 12½ acres additional property, on which to erect a drop forge foundry building and other additions.

The Gilson Mfg. Co. have just completed an addition to their premises 80 ft. long by 120 ft. wide, three storeys in height.

The Louden Machinery Co. are now occupying an addition to their foundry 50 ft. x 106 ft.

The Northern Rubber Co. completed their new building this year. The building is 80 ft. x 200 ft., 4 storeys in height, and is said to be one of the most complete factory buildings in Ontario.

The Partridge Rubber Co. are occupying an addition just completed 150 ft. x 120 ft. wide, four storeys in height.

In addition to the above the Taylor-Forbes Co. are planning to erect a new factory building that, it is said, will cost $280,000. The Guelph Carpet & Spinning Mills have announced their intention to erect an entirely new building in 1921. The Sherer-Gillett Co., of Chicago, have purchased ground on North St. and have announced their intention to erect an additional building on this property next year.

The population of the city has shown an increase for 1920 of 980 people, and the assessment has increased during the year by $1,162,000. In this is included new houses that are valued at $410,498, which are now in various stages of completion. The prospects for the city for 1921 are very bright and apparently there is no let-up as far as can be seen in any of the local factories, all of which are running on full time with plenty of work available for everybody.

OWEN SOUND HAS NEW PLANTS

Several Now Operating and Another Expects To be Turning Out Electric Washers Early in the Coming Year

By GEO. MENZIES, Secretary Owen Sound Board of Trade

OWEN SOUND.—Owen Sound is growing. During the past year several new industries have located here, viz.:

The Clinton Knitting Co.

The Circle Bar Knitting Co.

The Grey Mattress Co. and

Taylor Bros. Jam Factory.

The Clinton Knitting Company have already found their premises too small and are enlarging their factory to double capacity.

The Circle Bar Knitting Co. occupy a large three story building and are contemplating building an addition.

Another new industry is just about ready to commence manufacturing, viz.: The Slade Manufacturing Co., manufacturers of electric washing machines. This firm is now installing machinery and expect to commence operation about the 1st of January, 1921.

WIRE PLANT IS REBUILDING

Collingwood Industry is Being Reorganized And Expects to be Operating in The Near Future

By W. A. COPELAND, Secretary Collingwood Chamber of Commerce

COLLINGWOOD.—The largest development of importance in the industrial life of Collingwood during the present year is the fact that the plant of the Imperial Steel and Wire Company, Limited, destroyed by fire two years ago, is being rebuilt and is rapidly approaching completion, and expects to be again in active operation early in the coming year.

BELLEVILLE HAS SEVEN IN ALL

Claim to Have a Very Good Labor Market And Populous Surrounding Country—Prospects of More Factories Coming

By J. BONE, President Belleville Chamber of Commerce

BELLEVILLE.—During the past year seven new industries have located in Belleville, one of them being a branch of an American industry, namely, the Teco Company, makers of pancake flour.

Other industries are: H. A. Wood Manufacturing Co., Limited, makers of automobile valves; Toronto Hat Co.,

Limited, hats and caps; Natural Tread Shoe Co., Limited; A. S. Richardson Co., Ltd., manufacturers of wax figures and shop fixtures.

The Elliott Woodworking Machinery Co., Limited, along with the four last named industries, moved here from Toronto where they found much improved conditions in labor and power. Another new industry is the Judge-Jones Milling Co., Limited, who have built an elevator with storage capacity of about 40,000 bushels.

There is also the prospect of our securing a new glass industry and some others, all of them being attracted by the very desirable labor conditions and the populous surrounding country from which this city draws labor by motor bus, etc.

MORE U. S. PLANTS ARE COMING

Hamilton in Negotiation With a Long List, Some of Which Will Come as Soon as More Power is Available

By C. W. KIRKPATRICK, Commissioner of Industries and Publicity, Hamilton

HAMILTON—Despite the handicap of electric power shortage, from which practically all of the Ontario municipalities have been suffering for the past two or three years, Hamilton during 1919 enjoyed another period of unusual industrial development and prosperity. Lack of a sufficient power supply unquestionably kept a number of large manufacturers, particularly Americans, from locating, but inasmuch as the conditions existing in Hamilton were typical of power conditions existing in other desirable Canadian manufacturing centres, the majority of the industries did not decide to locate elsewhere, but wisely deferred action until such time as conditions right themselves and the situation becomes normal. Present indications are that with the coming of spring, or about April 1st, power problems, at least so far as industries are concerned, will become a thing of the past, and as a result increased industrial activity may be looked for during 1921. A number of American manufacturers, with whom the local industrial department had negotiations during 1920, intimated their intention and desire to resume these negotiations just as soon as the Hydro Department was in a position to discuss all-the-year-around power contracts and there are, therefore, good reasons for expecting that 1921 will be a banner one in industrial activity.

But, to get back to 1920, Hamilton has no reason to complain of its industrial growth during this year of more or less abnormal conditions. In fact, with the exception of 1919, it was probably the best year the city has enjoyed industrially since 1911. A total of 25 new industries was added to the city's already long list, and while the majority of them were comparatively small, being capitalized at from $25,000 to $100,000, many of them are branches of large American concerns that give promise of speedy development, providing that tariff and other conditions continue favorable to Canadian industrial growth. Among the branches of American concerns to select Hamilton as their Canadian headquarters were:

Peterson Core Oil Co., Chicago, Ill.
Canadian Nathan Co., New York, N.Y.
Don-O-Lac Co., Rochester, N.Y.
Metlskin Co., Rochester, N. Y.
Moto-Meter Co., Long Island City, N.J.
Canadian Libbey-Owens Sheet Glass Co., Charleston, W. Va.

American capital is largely interested in others of the new industries, although they are not actually Canadian branches of existing American companies.

The largest new industry to locate in Hamilton during the year was the Canadian Libbey-Owens Company, manufacturers of sheet glass under the Libbey-Owens patent. The Canadian company is capitalized at $5,100,000, and its Hamilton plant, which is now under construction, will, when completed, represent an expenditure of upwards of $2,000,000. Although building operations are being rushed, the contractors estimate that it will take nearly a year to complete the buildings, but when completed they will be the last word in glass factory engineering and construction.

The city's industrial building permits for the year total considerably over $2,000,000 and this figure does not represent more than one-half the actual value of the buildings erected.

In addition to the new industries secured, there was, during the year, marked development among the existing industries. The Dominion Foundries and Steel Company recently completed the erection of new buildings and installation of one of the finest plate mills on the continent, at a cost of a million and a half dollars; the Canadian Cottons, Ltd., has, nearing completion, a seven story spinning mill, which represents an outlay of close to a million dollars; the Steel Company of Canada has under construction a wire products mill, which represents an expenditure of about half a million dollars, while the Mercury Mills, Chipman-Holton Company and other textile industries made very considerable extensions during the past twelve months. The progress of the city can best be gauged by the assessment returns completed in October 1st, last, which show an increase for the year in the assessment of upwards of $30,000,000 and in the population of 6,623.

Hamilton's industrial growth is the more remarkable in view of the fact that the city does not offer any special concessions in the way of bonuses, tax exemptions, fixed assessments or land grants to incoming industries. It has found from experience that the really desirable industries do not seek special favors but are willing, when manufacturing and distributing conditions are favorable, to become part of the community on equitable terms, bearing their fair share of the tax and other burdens and enjoying to the full the privileges the municipality offers. One or two industries were lost to the city during the year by reason of the evasion of Anti-Bonusing Act by some of the smaller municipalities, but, on the whole, Hamilton has no reason to regret its stand against the purchasing of new industries at the expense of the smaller taxpayer. That its policy meets with the approval of the manufacturers themselves is shown by the fact that the biggest boosters for Hamilton in the securing of new industries are manufacturers already located here.

SHERBROOKE HAS HAD MANY

Many Industries Went There in 1920, and Conditions Are Reported as Being Very Favorable There Now

By J. H. BROSSEAU, Secretary-Treasurer Sherbrooke Board of Trade

SHERBROOKE, QUE.—The following manufacturing companies with details in regard to their production and number of employes may be of interest to your publication:—

Julius Kayser & Co., Ltd., manufacturers of high-grade silk gloves, hosiery and underwear; number of employees 500; cost of plant $1,000,000.

The Superheater Co., Ltd., manufacturers of superheaters for locomotives and marine and stationary boilers; number of employes 150; cost of plant $200,000.

Canadian Sturdy Chain Co., Ltd., manufacturers of shirts, collars and cuffs; number of employees 150; cost of plant $50,000.

Regal Tire & Rubber Co., Ltd., manufacturers of automobile tires; number of employees 100; cost of plant $300,000.

Cluett, Peabody & Co., subsidiary, manufacturers of shirts, collars and cuffs; number of employees 150; cost of plant $50,000.

The Canadian Connecticut Cotton Mills, manufacturers of tire cotton fabric; number of employees 1,000; cost of

extension when completed will represent an investment close to $5,000,000.

Pressure Proof Rings Co., Ltd., manufacturers of pressure proof rings; number of employees 25; cost of plant $25,000.

English & Scotch Woollen Co., manufacturers of men's clothing; number of employees 100; cost of plant $25,000.

Also Office Requirements, Limited, Goupil, Limited, J. H. Bryant, Limited.

One or two of our industries are feeling the effect of the depression to a certain extent, but the great majority have orders on hand which will tide them over to the revival of business. As a whole, will say that the industrial situation in Sherbrooke is in a prosperous condition.

A technical school will be built at the cost of several hundred thousand dollars. Municipal Hydro-Electric power development at Two Miles Falls, at an expenditure of over $500,000, will provide 5,000 additional horse-power for new industries. Sherbrooke has over 60 industries and its manufacturing products total over $50,000,000 per year. There are ample housing facilities to accommodate all the labor required to work all the plants now standing. In addition the city is now spending over $600,000 on a model city suburb of workingmen's dwellings and the program calls for 200 houses of modern design. The labor situation was never better, all kinds of labor is available, including male and female, both skilled and semi-skilled; the working man is happy and contented in this section of the country, no foreigners or Bolshevists in this locality. Our labor population understands that capital is absolutely necessary and capital knows that labor is equally needed, consequently with this reasoning, strikes are foreign to our people.

MORE WAREHOUSES ERECTED

Regina Grows as a Distributing Centre—More Building in View For the Coming Year —Many Homes Going Up

By CHAS. A. COOKE, Secretary-Manager Regina Board of Trade

REGINA—Despite adverse conditions created by the enhanced cost of material and labor, the City of Regina has experienced a large amount of industrial progress. Commodious warehouses have been erected by Wood-Vallance Company, Fairbanks-Morse Company, Goodyear Tire Company and the Saskatchewan Co-operative Creameries. The Leader Publishing Company have also added to their holdings a large storehouse.

Other constructions during the year embrace the new Presbyterian Carmichael Church built at a cost of $40,000; power house at the Parliament Buildings; four-storey business block of the Regina Trading Company; new Capitol Theatre, and upwards of 200 residences.

Projects for next year include a distributing house for Canadian Swift Company and a college to be erected by the Lutheran body.

SASKATOON'S RAILROAD SHOPS

Building Figures of the Year Show Very Marked Increases Over Previous Year— Big Car Shops are Contemplated

By GERALD GRAHAM, Commissioner Saskatoon Board of Trade

SASKATOON—The outstanding features of the 1920 building program in Saskatoon have been the beginning of construction of new C.N.R. shops and round house, the new Provincial Normal School and the new Physics building of the University of Saskatchewan. As part of the C.N. Railway program a new bridge is also to be erected on the side of the existing one. With the establishment of the mid-Western headquarters at Saskatoon it may reasonably be expected that further building will take place this year, also solve the completion of extensive new freight office and general superintendent headquarters and extensions of the express companies premises now under way. The sum of $800,000 has been set aside for immediate work here, but confirmation of the figure is not obtainable. The new Normal School is well under way and the site, overlooking the whole city, is exceptionally advantageous. The building is to be in brick and Bedford stone in the Gothic style, similar to that which the University of Saskatchewan has in all its buildings. The building will cost approximately $750,000. The Physics building at the university will, of course, conform to the style of others on the campus and the building permit shows a minimum expenditure of $403,000. Some of the other larger permits during the latter part of last year and during the past summer are as follows:—

Description of Building	Minimum
Coca-Cola Company	20,000.00
Franklin Garage	12,000.00
Chevrolet Garage	15,000.00
Y.M.C.A. Hut	20,000.00
Roy Garage	15,000.00
Auto Garage	20,000.00
Barries' Limited store	20,000.00
Addition to C.P.R. station	20,000.00
Riddell Carriage & Motor Works	20,000.00
Green Court apartment house	20,000.00
Imperial Bank alterations	15,000.00
Drycleaning establishment	20,000.00
Quaker Oats Co., Ltd., additions	86,000.00
Physics building at university	403,000.00
Mayfair school	184,000.00
C.N.R. roundhouse	45,000.00
New skating rink	25,000.00

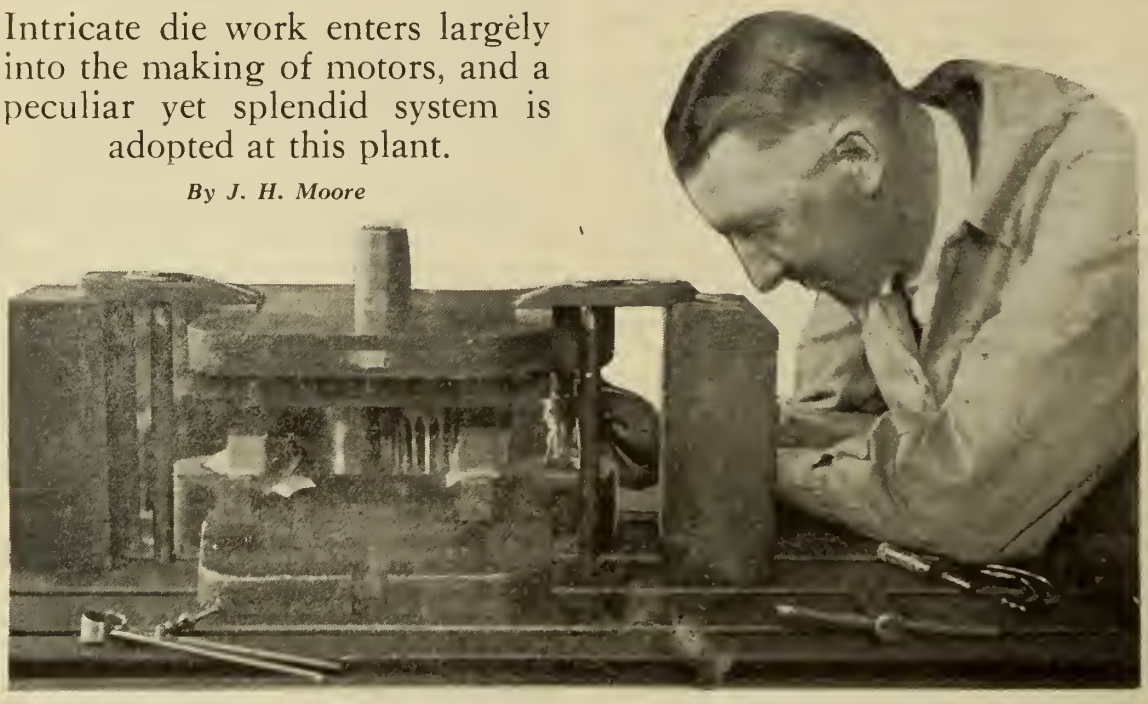
For the year ending September 29th, 1919, the total of building permits was $1,359,390 and for the year ending September 20th, 1920, the total is $5,160,105, thus indicating that a considerable building program of a public character has been under way. One of our most pressing needs is a larger hospital which has been considered for some years and which will be undertaken as soon as the city has funds. The matter of a public library is in the same category.

SUCCESS is not made by lying awake at night, but by keeping awake in the daytime

Turning Out Small Motors in Quantity

Intricate die work enters largely into the making of motors, and a peculiar yet splendid system is adopted at this plant.

By J. H. Moore



SPLENDID working conditions, ideal lighting, novel and accurate die work, these are some of the features found at the Canadian plant of the Robbins and Myers Co., Ltd., Brantford, Ontario. The data to follow will not only cover a brief description of the plant itself, but will include details of operations performed, items of general interest, and a detailed account of how this concern prepare their product.

Before entering the plant, one is struck with its neat exterior appearance. The building is of one story construction. The main office occupies the centre portion of the building at front, while the women enter at a right hand entrance, the men at a similar left hand door.

Beautiful flower beds, and a lawn of deep green give the building a regular country aspect, but on entering the plant one is really not sure whether he is actually inside a building or not. The lighting is perfect. A good high roof, well windowed and ventilated, throws ample light down, while the sides and end of the factory are also well provided with similar windows. Any plant arranged in the manner of the one we are speaking of, certainly deserves favorable comment.

The flooring is of wood blocks tarred in, and, as is well known, this type of floor saves to a considerable extent the workers' feet, the placing of machinery has also received close attention, the various departments being well laid out, and the machine tools segregated to the best advantage. Ample aisle space is allowed, in this way avoiding any confusion or congestion of trucking. Quite a number of operations performed at this plant are accomplished in a sitting position, for which splendid benches and stools are installed. Even the tool room operators are blessed with stools to sit on while their work is being completed. Tool stands are placed alongside each machine tool, and while the initial expense may be greater, the benefits derived soon pay for these stands.

Production Aids

For transporting material in the different stages of completion throughout the plant, trucks, and special stands are used wherever possible. It pays to make these, as it speeds up the work and keeps it so separated that it is easier handled.

Air lines are placed handy to all machine tools, and are used extensively to clean the tools of dirt, cuttings, etc. There is no need to go into detail regarding their raw stock and cutting off department, except to say that it is modern in every respect, and well arranged. As this is not intended to be a mere descriptive article, let us leave the generalities, and tackle the various departments one by one.

The Press Department

This section of the plant is set out by itself and the presses are arranged in a long line. Brown and Bogg presses are used, also presses made by the Bliss Co. The work performed is piercing, blanking, forming, and drawing, but as we intend showing these dies further on in the present article we need not dwell on this point at the present time.

Automatic Screw Department

This section is very well equipped and includes some large and small motor driven Cleveland and National automatics. There are also some No. 4 Warner and Swasey small lathes. The machines are arranged in ideal form. Screw work of all kinds is done in this department, also the turning of short shafts, pins, etc., etc.

Machine Department

In this section they have a full complement of floor grinders, buffers, disc grinders, Jones & Lamson lathes, Natco, and Leland Gifford drills. To give readers some idea of the work going through this department we have taken the operations performed on the washing machine motor body and head. This is of course only one type of motor, but will give readers an idea of the work entailed.

The Jones & Lamsons used are mostly of the double head type, and following are the sequence of the operations. The castings first go to the grinding end of the department and rough portions taken off. Now comes the turning of the head, which entails two operations, the turning of the inside, and outside fit.

The bodies are next bored out and faced. The photograph shown at Fig. 1 illustrates this operation, and it might be well to state that the hole is approximately 6⅜″ diameter, and is finished 3¼″ deep. The first station faces off the work by means of two ordinary tools, the second position has roughing mill cutters, and a roughing reamer for the centre hole, while the third position carries a boring tool for the centre hole. The last station holds the finishing mill cutters, also the finishing reamer, which is of the ball floating type.

Drill press operations on both the heads and bodies come next in order, but there is hardly any need to enter this in detail. Sufficient to say there are eleven operations.

After these operations have been performed, the parts go to the paint department, where they are sprayed with two coats of enamel. They are next placed in a Hoskins electric oven, which holds two racks, or approximately 600 to 700 parts at a time. They are baked in this oven for about three hours.

The operations on the Hoover suction sweeper motor while not exactly similar, entail the use of like equipment, so that we will pass on the winding department, together with the line of all machines used in conjunction with this department. These machines include Heald, Norton, and Landis grinders, Porter cable motor and belt driven lathes, some small Dalton bench lathes, some Mulliner lathes, some Rockford small lathes, a high speed riveter made by the High Speed Hammer Co., some Leland Gifford drill presses, and other tools of like nature.

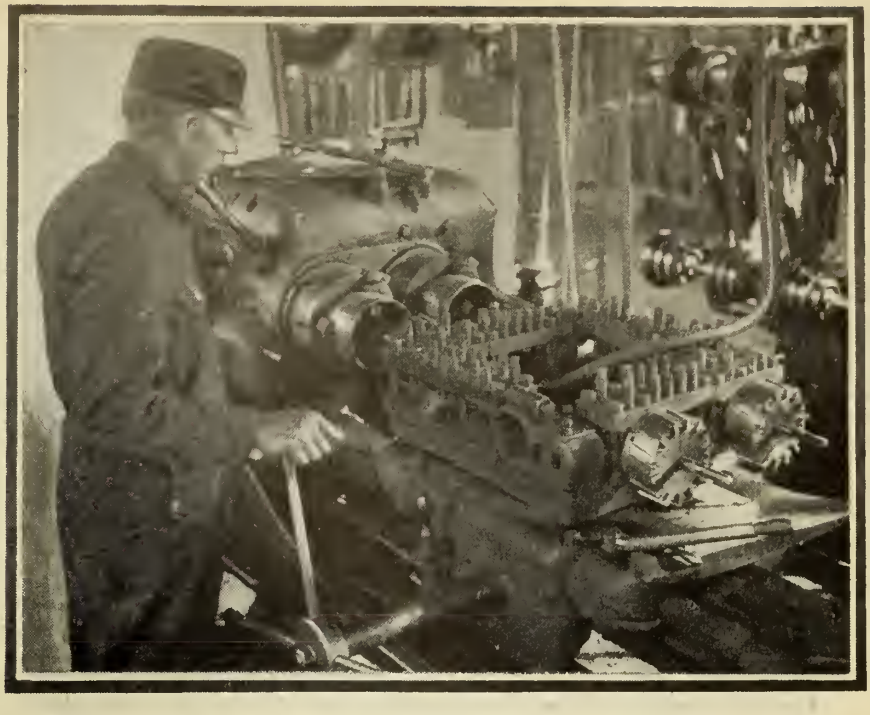


FIG. 1—BORING AND FACING THE BODIES OF WASHING MACHINE MOTORS.

Winding Department

The work entailed in the making of a motor for a suction sweeper is more than one would imagine, and while we cannot, in this space, tackle all parts and operations in detail, we give a few to illustrate the varied work. Take for example the shaft shown at H, see Fig. 2. This part goes through the following operations. First, the two shoulders are nicked by means of a special double tool on the lathe, then the second and third steps are turned to size. The wick hole is now drilled, and this operation is worthy of special mention. The hole is 3/16″ diameter, and is drilled through the centre of the shaft until a depth of 4″ is reached. The drilling of such a small hole to a depth of 4″ is a rather ticklish proposition, but they have overcome the difficulty very nicely.

A circular tank has been placed on the drill press table containing a good supply of soap water. In the middle of this tank, and in a vertical position, is the drill. It is held stationary of course. The work to be drilled is held in a quick grip chuck in the drill spindle, and revolves at a good rate of speed. The operator feeds down his spindle, relieving the work as often as deemed advisable. The method as described has resulted in greater production with less breakage of drills, insomuch that the work being drilled in a tank of soap water cannot clog, thus saving both time and drills.

The next operations in sequence are as follows: An oil hole is drilled, the slots for the two keys shown are milled, the first, second, third and fourth steps are ground, then the discs are assembled

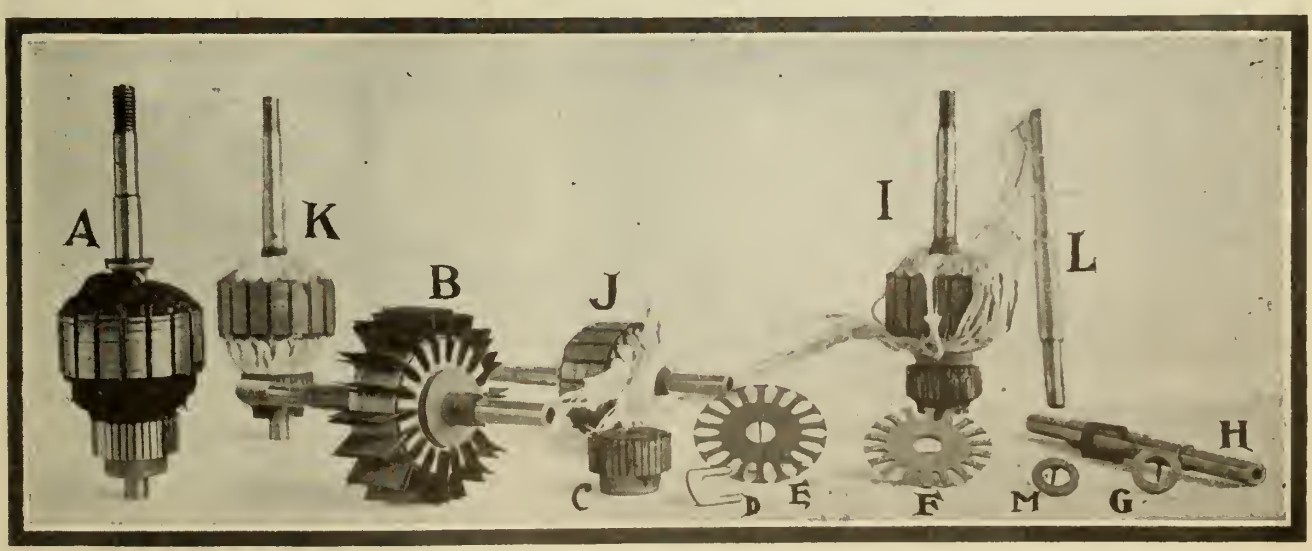


FIG. 2—THE VARIOUS STEPS ARE SHOWN IN THIS PHOTOGRAPH. FOLLOW THE TEXT TO GET THE BENEFIT OF THIS LAYOUT.



FIG. 3—WINDING AN ARMATURE.

on the shaft. Following this, the discs are straightened in the core, then sent to the winding department. Fig. 3 illustrates one of these winding machines at work.

In order that readers may get the greatest benefit from the description of these various operations we have photographed at Fig. 2 the shaft, and the parts going to make up a completed armature. We have lettered these parts so that the description can be easily followed. For example, A shows the complete armature, B illustrates one of the sections, while C shows a commutator complete, D depicts one of the wedge shaft keys, E the metal sheet disc, and F the fibre disc. G shows a fibre washer, H a completed shaft with a key partially inserted. I depicts the armature ready for inserting the leads, J the armature ready for the commutator, K the armature ready for soldering the commutator, L represents the shaft in the rough, while M depicts the steel thrust washer.

The view opens one's eyes to the number of parts entering into the makeup of a complete armature, and the photograph of course shows but one type of armature made at this plant.

Assembling

We will now suppose we are going to assemble an armature as shown completed at A Fig. 2. The shaft is first banded with gummed paper, then the slots are insulated with fibre sheets forced into a sort of a U shape as shown. Previous to this, of course, one of the keys has been driven into position and the discs placed on the shaft. First comes a fibre disc next to the key, then come the metal discs, finishing up with another fibre disc, and the second key.

After the insulation has been placed in the slots, the armature is wound as shown in detail view at Fig. 3. These machines have dials on them somewhat similar to a milling machine disc plate. A series of holes go around the outside, and there is a brass pointer which can be set at any position. The holes are numbered from one, up. Depending upon the armature to be wound, the wheel or dial must turn so many holes past the pointer, which, by the

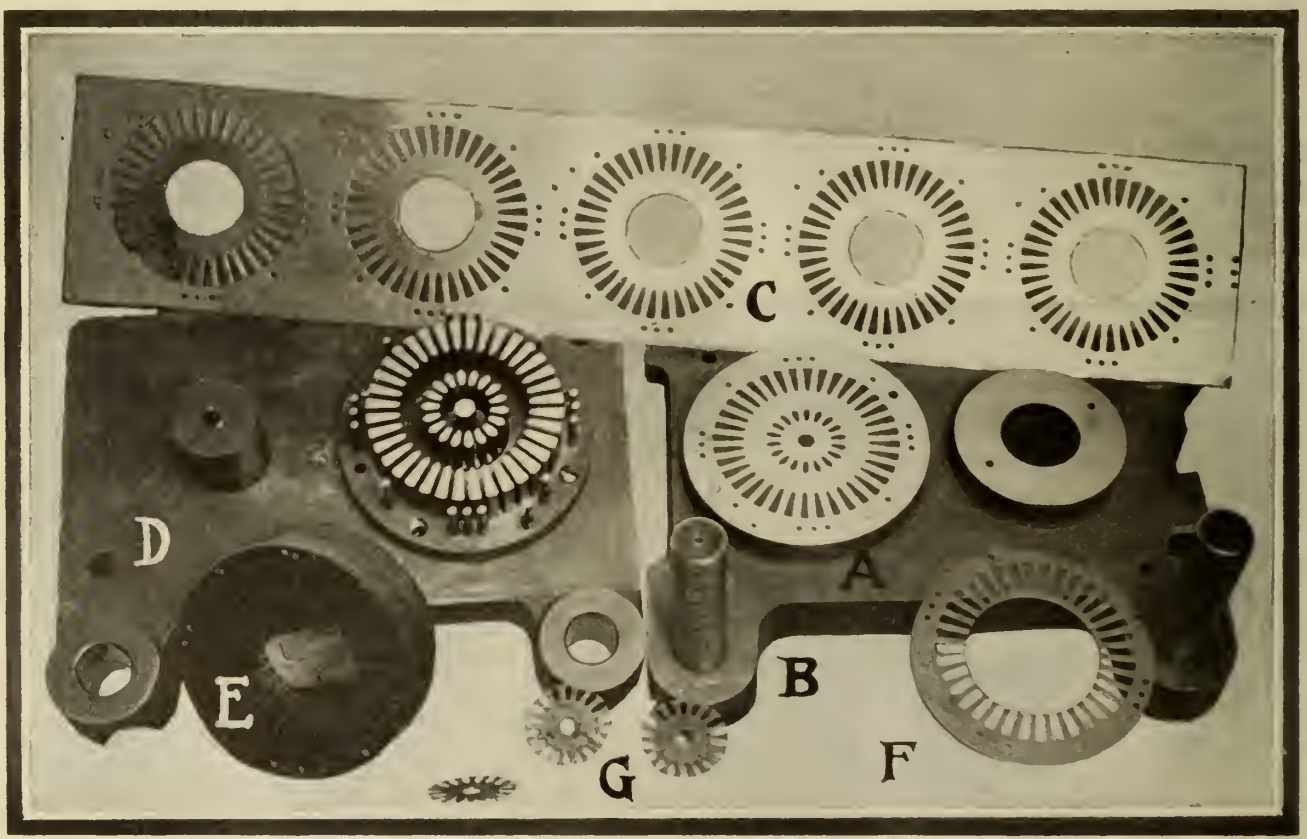


FIG. 5—HERE IS A GOOD EXAMPLE OF A DOUBLE ARMATURE DISC DIE.



FIG. 4—SOME OTHER DETAILS OF INTEREST, DEALING WITH MISCELLANEOUS PARTS.

way, never moves. To watch the girls judge the correct number of turns, which may run into so many revolutions, plus so many holes is a treat. Like everything else, they get so used to it that the action becomes second nature.

After winding, the fibres are bent down, then the work is tested for opens

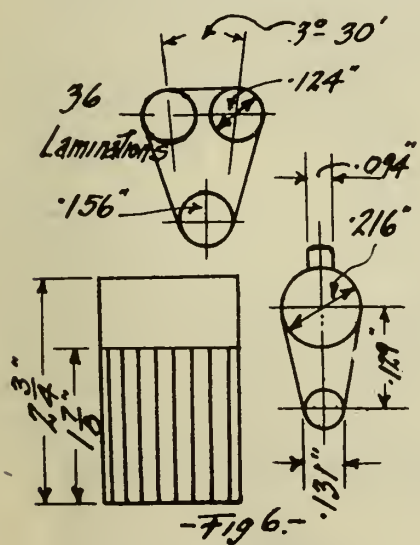


FIG. 6—DETAILS OF SLOTS, AND DEPTH OF PUNCH MILLING.

and grounds, after which it is thoroughly inspected.

The commutator is next pressed on, and the leads inserted. The soldering of the leads comes next. Inspection of the soldering follows, also greasing of the shaft. The commutator is now rough turned, and the shell turned to size to suit a little protection cap that goes over it. It is now tested for grounds, opens, reverses and shorts.

After these operations, the work is dipped in insulating varnish, and put in an electric oven, where it is baked for 10 hours. The thrust washers are next pressed on, and the shaft straightened, as it is imperative that the shaft run absolutely true. The first washer is now faced, and the distance over all between the face of this thrust collar, and commutator shell is procured. The commutator is next finish turned and sanded with No. 00 sandpaper.

The core is now ground, and the front end of shaft is finish turned to size. An oil hole is next drilled in the commutator shell, and is so drilled, that a continuous stream of oil reaches both the top and bottom bearings. The work is now balanced, and the balance is made up by means of small wedge-shaped pieces of brass. The fibre washer is next pressed on the shaft, after which it is faced. A small slot is milled at the end of the shaft, when the now completed armature is sent to the test department. Considerable information of value can be gleaned by following these steps of manufacture with the photograph showing group at Fig. 2.

Field Core and Other Parts

To follow the next operations, let us refer to group shown at Fig. 4. A, represents a field core, and of course these are first punched out in the press department. On reaching the assembling



FIG. 7—ILLUSTRATING THE METHOD OF FINISH FORMING SLOTS IN ARMATURE DIE.



FIG. 8—SHOWING TWO OF THE FILING MACHINES AT WORK.

stage they are put together in the following manner. An assembling fixture is used which gauges the correct number of discs to make up the core. Two rivets hold the core together.

They are next ground, and as there is a flat spot on each side of these cores, they are placed on a mandrel, and are staggered so that the grinding wheel is always removing stock. The grinding of the outside diameter is the next operation in sequence. It might be well to mention that in the assembling of these cores this concern has employed a blind man as one of their assemblers, and in spite of his handicap he can turn out as good work as the others. To watch him perform is a sight in itself, and were one unaware of his affliction, they would hardly believe such to be the case, so dexterous are his movements.

The cores being ground, the coils are next given a slight curve in an air press. This coil is noted at B in the photograph. After being formed they are inserted in the core, and the terminals are next soldered to the coils.

Making the Commutator

The punchings, both copper and mica, are made in the press department, and on arriving at the assembling department are placed in circular form as follows: A copper section, a mica section, and so on. The sections are pressed into a steel ring as shown at C. The sleeve is now insulated, as shown at D, after which sleeve and collar are assembled. The commutator is next locked by means of a wire and pressed out of the ring. This is shown at E.

They are now inspected to see that copper and mica are perfect, after which they are covered with bakelite and baked. A rough cut is next taken off the outside diameter of commutator, then the rear shell is faced to length. The holes are next reamed to size, and one end of the hole is chamfered. The sleeve is now milled with a small slot at its end. They are next tested for shorts and grounds, after which they are ready to assemble on the armature.

Field Coils

The field coils are first wound to the specified number of turns, and taped with what is known as empire cloth. This cloth is really a sort of linen, so coated that it takes 2,000 volts to jump through it. This provides a perfect insulation. They are next taped with muslin tape, the leads are soldered, after which they are dipped in an air drying black varnish. On coming out of the dip they are allowed to dry in the air. There are, of course, other innumerable little details such as turning of brush rings, bearings and so on, but sufficient has been given to illustrate the systematic method of following up this class of work.

To make a washing machine motor is an entirely different proposition as the design is different in many respects, but we will not enter into this matter, as some of the work is very much a duplicate of that already described. The other parts shown in group at Fig. 4 are as follows: F illustrates a single disc of which the completed field core is made, and C shows the same in an assembled state with the coil attached. H and I illustrate the copper and mica sections going to make up the commutator shown at J. The other portions need not be lettered as they are merely parts going into the make-up of a motor. The brush rings can be clearly noted and need no special comment.

The Die Department

It is hardly necessary to call reader's attention to the fact that work of the nature we have just described entails considerable punch press work. This work is also of a very exacting character so that the data to follow on the die department will in itself be of real value to the mechanic. It is not often one runs into a similar line of die work and for that reason we have gone into the matter very carefully, giving figures of value and interest to the mechanic in general.

Die work at any time is a fascinating subject, but the dies about to be de-



FIG. 9—A NEW AND USED DIE BLOCK. THE NEW ONE IS 1¼" THICK, THE USED BLOCK ONLY ⅛" THICK.

scribed are of more than passing interest. Their armature disk dies are the chief feature, but before speaking of the die, it might be well to explain that these disks are made from a grade of sheet iron approximately 0.025″ thick, termed electric iron. This material is used because of its low resistance to an electric current, or to use the proper expression, the material is used because of its permeability. Though very soft, it is difficult to punch, the wear on the dies being considerable. In the average plant, a die of the nature shown at Fig. 5 would be made altogether different from the method employed by this concern. The photograph depicts a double armature disk die, the outside punching being for a larger motor than the inside one. To give readers some idea of the dimensions of the slots in these dies we have drawn the sketches shown at Fig. 6.

It has been considered bad practice by some concerns to make such dies or punches solid, because the thin strips of metal remaining are likely to warp in hardening and break. Another argument made is, that if made solid, repairing becomes more difficult.

These objections have been swept to one side as far as the firm we speak of are concerned, for not only do they make their dies solid, but their punches as well. This procedure not only calls for good tool work, but mighty particular care in the hardening operations.

Construction of Die

It would seem that all regular practice has been tossed aside in the preparing of these dies, for the die shown is not even of the sub-press type, as usually followed out, but is of the plain blanking type of construction. The blanking die A is made from a solid piece of steel in which the required number of slots are machined. The die fits into a slide in the die shoe B, and is held as shown. C illustrates a portion of stock punched, D the punch block itself, E some assembled disks of the large size, F as a single disk after centre portion has been blanked out, and G two of the centre disks. It will be noted that the first portion of the die punches out both the slots for large and small size disk, and to give readers some idea of the task let us refer to Fig. 6 together with the following description:

There are 36 slots in the outer die, these being .156″ at the small end, and considerably wider at the other. Two .124″ holes are drilled 3 degrees and 30 minutes apart, then slots are filed to a finish. The inside disk has 18 slots the slot in this case having a tit as shown. This tit is .094″ diameter. The large portion of slot is .216″, the small part .131″. The distance between the holes drilled is .129″. These dimensions if studied will show the care that is necessary in completing such a die correctly. The punch is another ticklish proposition; as can be noted the slots go down 1⅞″ deep, and of course the punch must suit the die.

Let us suppose we are watching the making of a die similar to that shown in the photograph. The die shoe is first machined to size on the shaper, and as this is ordinary tool work, we need not dwell on the matter. The shoe being completed it is passed over to the man making the die.

The steel used in the making of the die block is always of a guaranteed oil hardening, non-shrinkable brand, and it might be well to state that Vasco and Deward steels are being used by this concern at the present time. Ketos steel is also used with considerable success.

The die block is first cleaned up all over to ensure getting below the decarbonized surface. They now heat the block to either a blue or a yellow color. This is done for marking off purposes, as they do not use the regular style of wiping the block with soapstone. They claim such an artificial surface wears off before the die is completed and is not suited for their purpose. Having colored the block, they proceed to mark off the die, but again deviate from all regular practice. No templets are used, the die being laid off direct from the drawing. This statement may not sound much to the layman, but to an experienced tool maker it speaks of much needed accuracy and confidence in one's laying out powers.

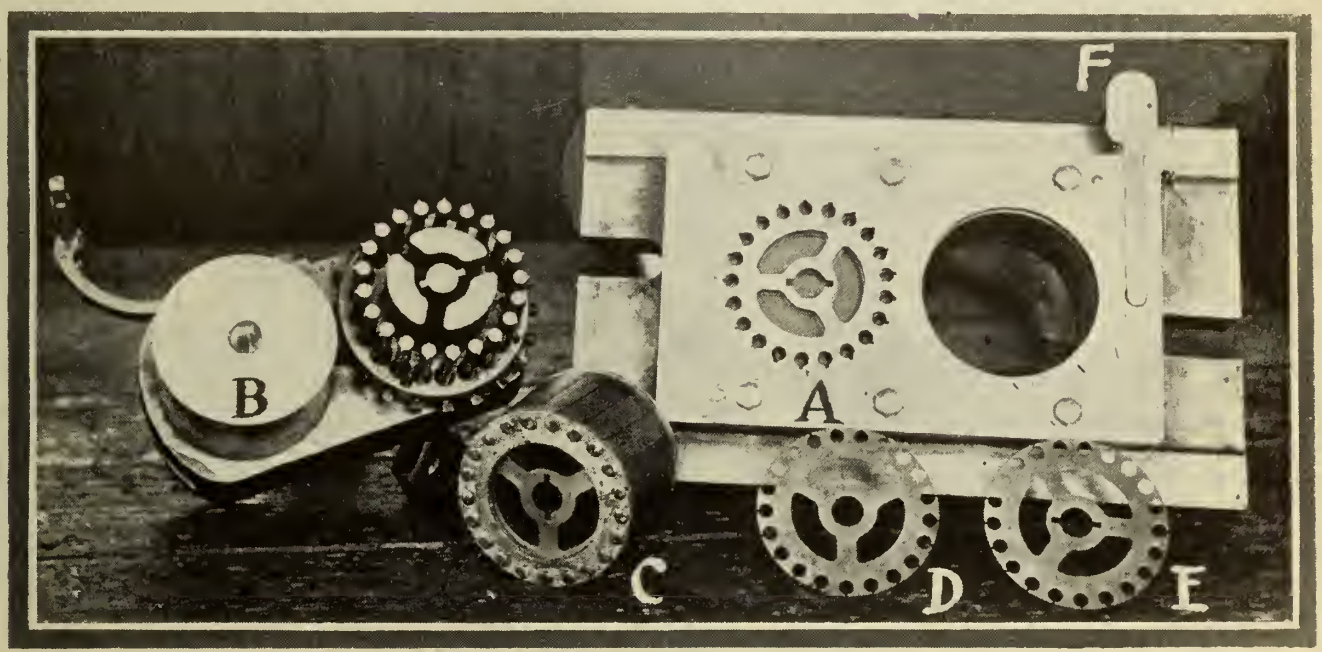


FIG. 11—ARMATURE DISK DIE FOR 17WW MOTOR.

The block is now ready for working out the elongated slots which form the projections on the armature disks, and the first step is to drill a series of equidistantly spaced holes entirely through the block. This work is done on the milling machine, the dividing head being used for spacing of holes exact. A Bushing type of drill chuck is used in the miller spindle, and this chuck carries a drill of the correct diameter. The internal ring of holes is usually drilled first, then the size of drill is changed when the exterior holes are next drilled. Sometimes the procedure is reversed. Following this, a series of holes are drilled so that they just break into each other. After these holes have been completed the intervening webs are removed by shifting on the large disk shown at Fig. 5. 296 holes were drilled before the webs would be drifted out.

The next step is to finish form the slots, this being performed as shown

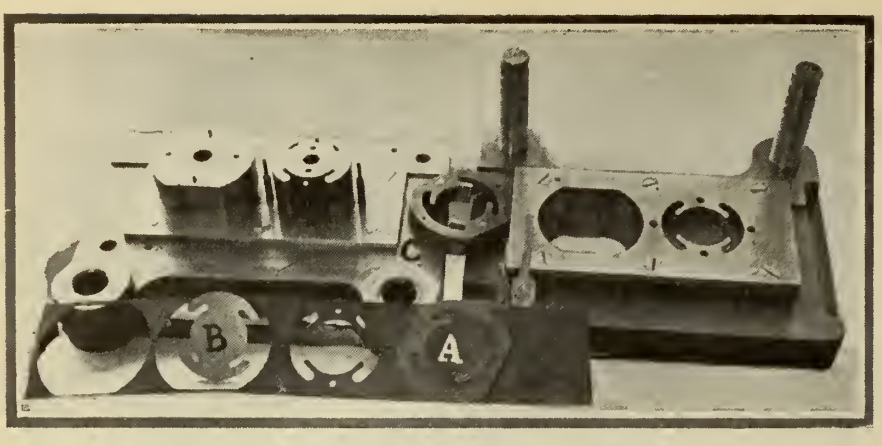


FIG. 12—DETAIL OF A FIELD CORE DIE.

at Fig. 7. The work is done on a No. 2A Brown & Sharpe miller with a slotting attachment placed on the spindle head. The die is mounted on a tapered arbor, which is held in the dividing head of the miller, while slotting tools of the correct shape are fastened into the head of slotting attachment. The dividing head is held perpendicular, and the slotting attachment is also set perfectly square, this producing a straight hole. The clearance is produced in the filing operation which will be described later.

The sides of the slots are machined first, after which the two arcs are completed. The outer arc has a slot as already described cut into it, and for this operation a tool of suitable shape is used to cut the slot. As before, the indexing attachment of the dividing head is used for spacing of the holes. Very light cuts are taken during their operation, as were one to attempt a cut of even 1-64", distortion and general springing of the tool would result. Patience is a virtue on this work, care, rather than speed, being the chief consideration.

Finishing Operations

When these slots have been machined to their approximate size, the final operation consists of filing them to exact size on small filing machines as shown at Fig. 8. These machines are made by the Oliver Instrument Co., and consist of a table that can be set to any desired angle, and a file comes up the centre of the table of such a nature as to conform to shape of slot desired. The machine is driven by an individual motor, which by the way is one of their own make, and in addition to filing the slots to their correct shape, the machine also produces the correct clearance angle.

Here is another point where this concern follows a peculiar trail. They only allow .003 inch a side on these dies, the block being 1⅛" thick. This means that the table of filing machine is tilted over approximately 7½ minutes. Imagine a die 1 1/8" thick with only .003 clearance aside, and still this allowance has proved a decided success, and allows them to grind their dies down to actually one-eighth of an inch thick. Sounds like a rather wild statement, but look at the photograph Fig. 9 of a thick and thin die, and be convinced. The die illustrated was made from Ketos steel.

The die block is now hardened, being heated up to 1375F. to 1650F., depending upon the nature of the steel and the shape and size of die. It is now drawn all the way from 300F. to 500F. For hardening, a Hoskins electric furnace, made by Hiram Walker & Sons, Metal Products, Ltd., Walkerville, is used. This is known as a high speed tool furnace and can be heated up to 2500F. if necessary. The heating is done gradually and uniformly until about 1100 F. has been reached before the hardening point heat is raised. The block is dipped into linseed oil and left to cool, after which the temper is drawn very slowly to relieve the strain.

The hardening of such a die as shown calls for considerable care, as the slightest amount of shrinkage or warpage would render it unfit for use. Being of the solid type it would be practically impossible to correct any distortion in hardening. It takes from five weeks to two months to make a complete die as shown, so that the loss would be considerable. It might be said, however, that although following out such a practice this concern have never yet lost a die in the hardening operation.

Making the Punch

The die block being now completed, let us consider how the punch is made. In all cases this concern make their dies first, then fit their punches to the hardened completed block.

The punch is made from a solid, round bar of stock, drilled, turned and recessed in the lathe. It is next slotted in the miller. The punch is driven on a tapered arbor, which is held in the dividing head of the milling machine, and a slotting saw of the required thickness is used to form the individual members of the punch. Depending on the size of the punch, two to five cuts are taken. The position of the cutter is always changed on the last cut. On some types of armature punches, where the slots between the different punch members vary in width at the inner and outer extremities, slotting saws of different thicknesses are used in order to reduce the amount of machining. When this is necessary, the saw is not inserted as already stated, but is raised slightly and the second saw is also raised. The remaining web is machined out with the slotting attachment.

In the case of a large punch, where five cuts are taken, the semi-circular, and the tit form are milled after the third or fourth cut. The change of cutters is made with a definite idea in mind, namely to use the form cutters before the members are split right through. This avoids chatter and distortion. The reason five cuts are necessary is self-apparent, namely, the punch must not

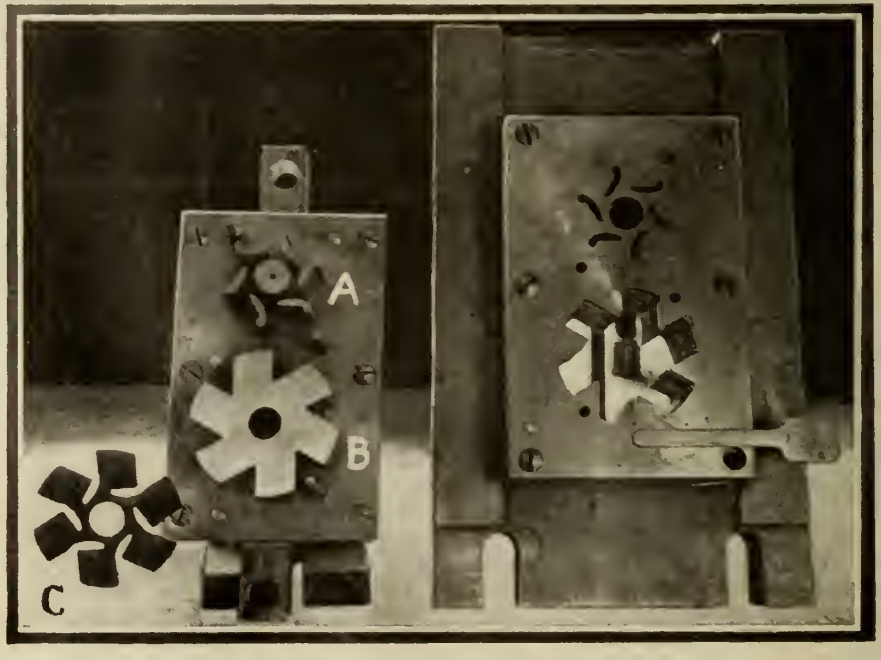


FIG. 13—DETAIL OF A FAN PUNCHING DIE.

be sprung in any way and a heavy cut would be sure to do this. The operations spoken of so far have been accomplished with the punch in a horizontal position, but in order to perform the finishing work, it must be turned vertically and the slotting attachment with proper shaped tools used. After this operation is completed a slight touch up with the file is all that is necessary.

The punch is now sheared into the die block for a distance of about 1/8" to ¼", when any excess stock is again removed. This shearing operation is performed on a regular style arbor press, and they are very careful to shear a very little stock at a time in order to found that the punch and die go together perfectly.

Believing it will be valuable data for tool makers in general, we append still further information on the die we have been speaking about. The clearance on the shoes to allow the punchings to drop out ranges from 1/64" to 1/32" a side, depending upon conditions, and every operation is set up on the machine by means of dial indicators. Every set up receives like care, for it is imperative that die be absolutely true. In order to secure an accurate measurement of the diameter of punches when milling the arcs, they use two round pieces of drill rod, letting them rest between two members of the punch. turn it. The adding of this small slot has overcome this difficulty.

As a rule the shoe is made about 2 11/16" deep, the die blocks 1⅛ to 1¼" deep, the stripper plate ⅜" to ⅝" deep and the guide pins from 1¼" to 1⅜" diameter. Wherever it is thought wise a pilot punch is used. For example, see the punch at Fig. 11.

The die Fig. 11 is used to punch the armature disk for their 17 W. W. motor, used on washing machines, and is certainly worthy of attention. As can be noted, there are 21 small punches used, each with a very small tit at the exterior. There is also the three web punch, and the centre punch, which has a tit on either side of it. As before,

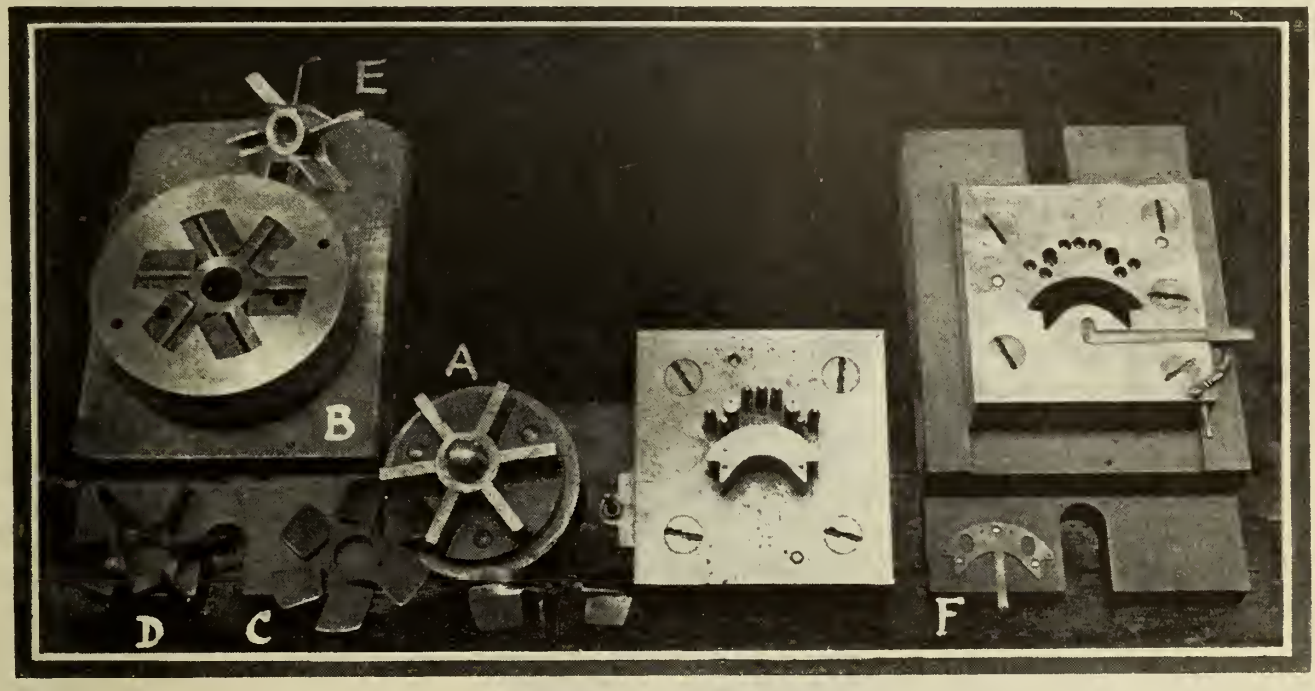


FIG. 14—ILLUSTRATING TWO DIFFERENT DIES. DETAILS ARE EXPLAINED IN THE TEXT.

place no undue strain on the finished die block.

The Guide Pins

As soon as the punch has been fitted correctly, it is assembled to the punch holder, and placed in the die for about 1/8 of an inch. The shoe with die in place, also the punch holder with punch in place is taken to the vertical miller, where the guide pin holes are drilled as shown in heading of this article. Note that parallel strips and paper keep the die and punch in perfect position while the holes for guide pin bushings are being bored. A Marvin & Casler offset chuck is used, which has a micrometer dial that makes it easy to set the boring tool to correct size of hole. This operation is known as the final drilling of guide pin holes, and after the work has been taken from the machine, the guide bushings are ground to fit the holes just bored. The bushings are next pressed in place, the guide pins assembled, when it will be The micrometer measures the distance from these drill rods, then the distance equal to their diameter is deducted from the measurement found.

It will be noted by referring to the further pictures of various dies used, that one style of gauge is universally adopted. This is a very simple gauge and can be seen at F at Fig. 11. It consists of a steel finger, connected with a small spring to the stripper. On the punch block is a pin which hits the end of this finger as the ram descends, thus lifting the other end of the finger where gauge pin is inserted. This, of course, allows the stock to press through.

Before milling the punches, a small notch of about ⅛" wide, and of similar depth, is placed at the back of the punch. This notch keeps the punch from turning while being milled. They did this because they found that even though the punch was forced on a tapered mandrel, the vibration had a tendency to the die is made solid, and entails considerable accurate work. This portion is of course covered by the stripper A, but as it practically takes the same form, readers get the idea quite clearly.

The blanking punch B is made solid, and it will be noted that a small pilot is used to centre the blank correctly. The 21 punches already spoken of are made separately, but the three web punch is made from a solid piece. The centre punch is made separate, so that in reality, there are actually 23 punches used at this portion of the die. C represents an assembled core, D the disks used in the centre of the core, while E depicts the disk for which the die shown is made. Note that the only difference in these pieces is the absence of the tits in the disk D. F depicts the gauge, which has already been explained.

Field Core Die

The die depicted at Fig. 12 needs little comment as it is self-explanatory.

Continued on Page 592

Making Parts for Universal Plate Mill

Operations in the making of universal rolling mill equipment—The machining of rolls, and boring work on sections—Machine work on certain parts of rubber mill equipment.

By J. H. Moore



NEW tendencies and developments in Canadian industry are always interesting. This is especially true of the variety of work at present proceeding in the plant of the Dominion Steel Products Company, Limited, Brantford, Ontario. To discuss all the classes of work being produced is not possible in this space, but we shall take up the two chief propositions which they are handling.

To explain the first proposition, we must in fancy travel to Hamilton, Ontario, there entering the plant of the Dominion Foundries and Steel, Ltd. Here we see this latter concern installing a huge Universal plate mill, and it was this very installation that created the demand for tables for the aforementioned mill.

To make tables for a plate mill sounds like an easy proposition, but is it? Ask the company at Brantford, and see what they say. The number of parts to tables of this nature is surprising, and to form some conception of the general appearance of one of these tables, let us refer to Figure 1. As will be noticed, the table consists of a series of rollers, driven by motors conveniently placed. Depending upon the length of the table, one, two, or four motors provide the driving power. Each roller has a bearing at both ends, and, as can be seen, a bevel gear is keyed to one end of each roller. This in turn meshes with another bevel gear on the power shaft. As a rule the power shaft is coupled up at various place, depending upon the nature and length of the tables. This of course means that all motors driving the power shaft must revolve at the same rate of speed, and to accomplish this the motors are arranged in synchronism. While we have shown the bevel gears in full view at Fig. 1, these are of course covered in actual operation.



FIG. 1—GENERAL APPEARANCE OF ONE OF THE TABLES.

Without going into any details, let us run briefly over the various tables used, and the procedure in the making of a plate. The stock is of course taken from the yard by means of a crane, and placed in the furnace pusher. From this point the billets are pushed into the furnace, and on reaching required temperature come out on the discharge pusher. The stock next reaches the approach table, and, rolling up on this table, it soon reaches the front mill table.

It now passes through one mill, landing out in rolled shape on the back mill table. Continuing its journey, it passes from the back table to the runout table, and from there to a plate leveler. Next comes the hot bed, and in some cases more than one hot bed is used. The procedure from here on varies considerably, depending upon the nature of the plant, but sufficient to say there is still one more table, namely the back shear table.

We have quoted this routine of operations, not with any special plant in mind, but rather to bring before readers a general conception of the procedure.

The Sections

The construction of these tables is somewhat similar, being made up of various sections, bolted and keyed to-

gether. Take for example Fig. 2. Here we see six of the sections being machined on a Pond planer. The bottom of these sections is planed on four spots only, the rest being bedded in concrete when installed in place. The piece is then turned, and the top planed all over. Next the sides are planed as shown in the illustration, when other minor operations follow. As the photograph is self explanatory, we will pass on to a description of the main mill table section shown at Fig. 3.

This table section is 18 ft. 4½ in. long, 4 ft. 3 in. wide, and 2 ft. 1 in. deep. It has 13 roll bearings, each of 6⅛ in. bore. The first operation is performed on the planer. The bottom is planed on four spots, and the rest of bottom is bedded in concrete in actual use. Next, the work is turned, and the top planed all over. The side bearings are now machined to width and depth, there being five of these bearings, as shown at A. The work is next set up on a Landis boring mill, and the ends milled as shown at Fig. 4. This is a simple operation and needs no special comment.

The section is now set up as shown at Fig. 3 and the cap holes drilled. There are 44 of these holes to be drilled, the majority of them being 13-16 in. diameter, and they are drilled 10½ in. deep. The work is of course moved along as the job proceeds. The bearings are also finished at this boring mill and a peculiar practice is adopted in the boring of these bearings. The bottom half, that is the portion shown in sketch, is bored out to 3 1-16 in. radius, or equal to 6⅛ in. diameter, this being to accommodate a brass liner which has a bore equal to 5⅛ in. diameter.

The liner however is of half circle section, and goes to the bottom only. The cap has no liner, and is merely bored out equal to 5⅛ in. diameter. The reason no liner is placed in the cap is as follows: All the wear is downward on these bearings, therefore there is no need of a liner where it would never wear out. The method of supporting the work shown at Fig. 3 is



FIG. 3—DRILLING THE CAP HOLES ON ONE OF THE TABLE SECTIONS.

readily seen, so that no comment is necessary.

The next photograph Fig. 5 illustrates a few of the rolls going to make up one of the tables. The turning work on the rolls alone is a considerable item, and the few figures to follow will be of particular interest. The approach table, as made for the mill we speak of, has some forty rollers, ten table beams, seventy bevel gears of thirty-three teeth, 1½ D.P., and other numerous parts of like importance. The front mill table has twenty rollers, and the rear mill table contains a like number; 42 mitre gears go on each table, and all drive gears are keyed to shaft with two keys and coupling gears are held in a similar manner, but the roller gears have only one key. The rear mill table is driven with two 80 H.P. motors, and is also the front mill table.

Run out table has 58 rollers, and it might be well to add that these rollers are 14 in. diameter, 5 ft. in length of rolling surface, and 7 ft. 9 in. overall. The borings are 4½ in. and 5⅛ in. in some cases. Steel castings of course enter largely into the construction of these parts, although the caps for roller bearings are of cast iron. The motor drive gears on some of the tables are 29½ in. outside diameter, 87 teeth, 5 in. face, and 3 D.P. These gears are cast steel.

The run out table has two 50 h.p. motors to drive it, and the hot bed table has a similar equipment. The hot bed table has a grand total of 61 rollers. The reason these hot beds are made so long is in order to allow the stock to cool, much as this may sound contradictory. In other words, the hot bed is a resting place for the stock while it is cooling.

The keyways used to hold the bevel gears to the drive shaft are 1¼ in. wide, and two are used. The shaft for approach table is 5 in. diameter at the largest part, and is over 12 ft. long. As stated previously, all sections are aligned and keyed together, and this must be done accurately. Every bolt hole is spot faced on these tables and all bearings are specified on the drawings as follows: The shaft must have a perfect bearing over its full length.

The charging furnace pusher itself is an intricate piece of work. Most of the mechanism is underground, but roughly,

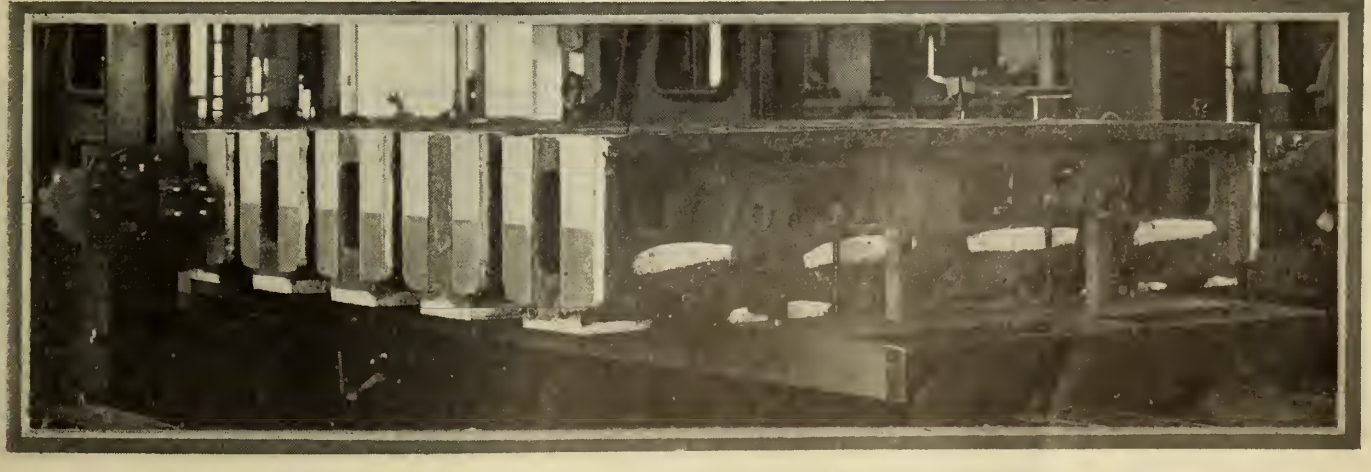


FIG. 2—SIX SECTIONS BEING PLANED ON A LARGE PLANER.

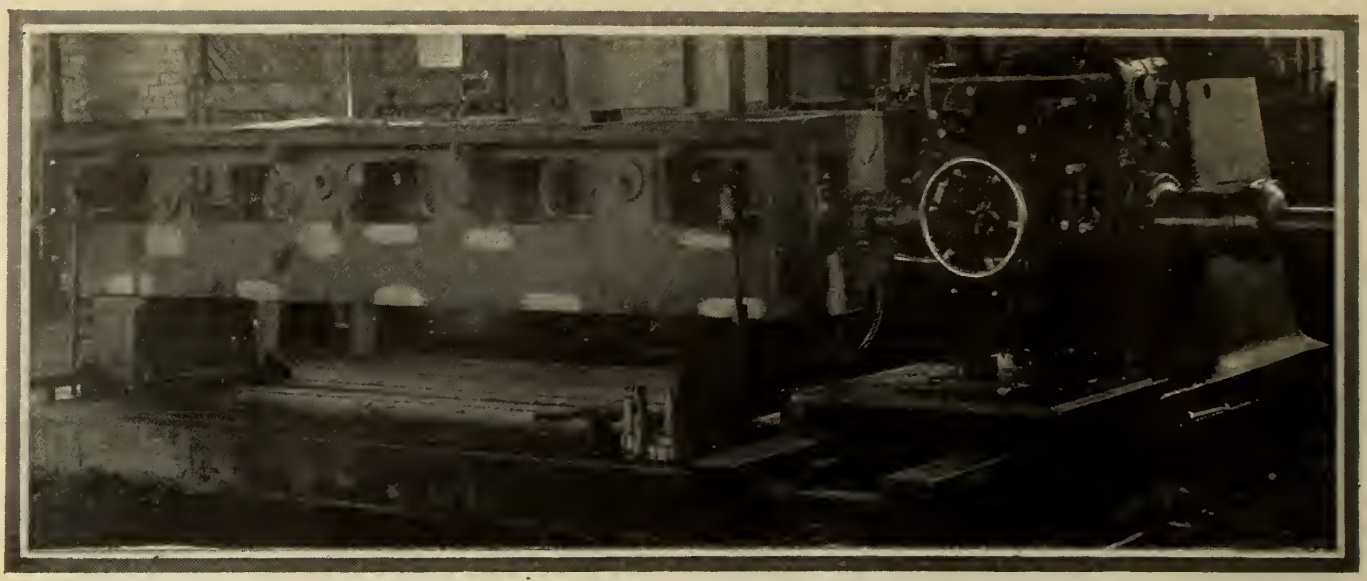


FIG. 4—MILLING THE ENDS OF A SECTION ON A LANDIS BORING MILL.

here is what occurs. A horizontal skid motion is developed through a lever and sliding arm, this pulling the billets over to the furnace. Two 20 h.p. motors drive the arrangement and there are



FIG. 5 A FEW OF THE ROLLS GOING TO MAKE UP A TABLE.

over 14 gears in the mechanism. There are various 118T—2D.P. herringbone gears used in the discharge pusher, which is, of course, the reverse idea of the furnace pusher, insomuch as the discharge pusher takes the billets away from, and not to, the furnace.

It can be easily understood that no sequence of operations can be given in an article of this kind owing to varied parts being made, but enough to say that other parts almost innumerable enter into the makeup of such tables. These include roller plates, lock washers, cap bolts, bracket bolts, nuts, keys, thrust collars, oil rings, gear guards, separator bolts, bearing caps, etc., etc.

The work entailed in the preparation of tables is surprising, one particular table being more than 145 ft. long. There is over 550 ft. of table space up to the shear delivery table alone. This is a new industry for this section of the country, and necessitates both a need of accuracy and a keen knowledge of requirements. The mill for which these tables are being made is of the Universal type, and can produce billets, blooms, sheets, bars, narrow universal plates, etc., etc.

Rubber-Mill Work.

Leaving the work on plate mill at this point, let us next consider the variety of work being accomplished by this concern for rubber working plants throughout the country. A sample of such work forms the title piece of the present article.

This view depicts the machining of a large ram for a special vulcanizing outfit. The work is 22 in. in diameter, 17 in.-5 in. long, and has a screw hole in one end that is threaded for a 4 in. taper plug. The other end has three ribs cast into it, spaced 60 degrees apart. This work must not only be machined but must be polished and free from scratches. There are also four 1 in. holes drilled at the webbed end of roll, and these holes are drilled to a depth

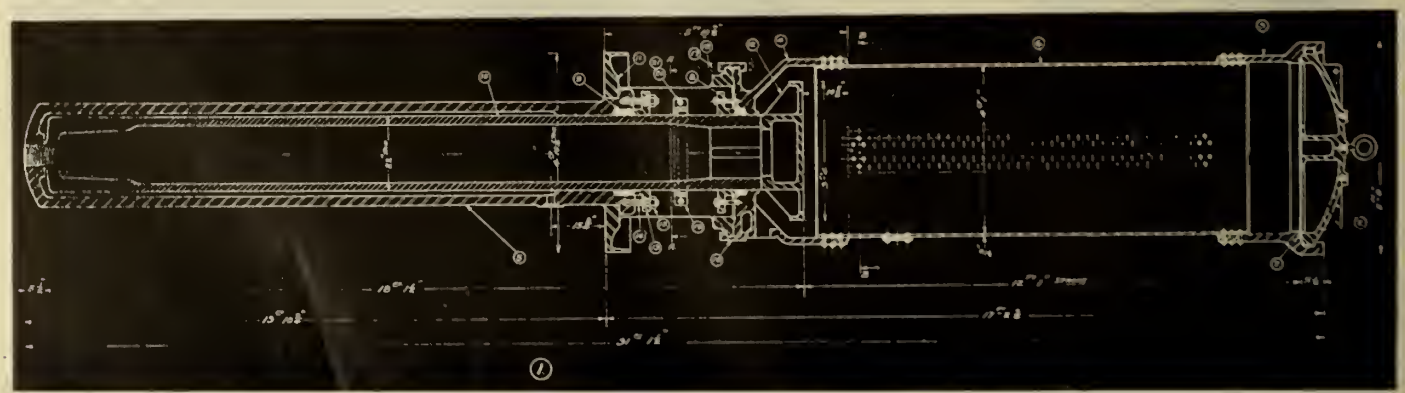


FIG. 6—SECTIONAL VIEW OF 48" VULCANIZER. TEXT EXPLAINS THE METHOD OF OPERATING.



LEFT HAND VIEW FIG. 7—THIS SHOWS A MOTOR BED PLATE BEING MACHINED.
RIGHT HAND VIEW FIG. 8—AN INTERESTING ASSORTMENT OF TIRE MOULDS.

of 21¾ in. The work on the latter operation is performed on a Landis boring mill. There is approximately 1¼ in. to 1½ in. to come off the diameter of these rams, in order to get to the perfect metal. The work is accomplished on a 33 in. Le Blonde lathe and takes approximately 50 hours to complete.

Let us next consider Fig. 6. Here we see a sectional view of a 48 in. vulcanizer that this concern recently completed, and a short description of same would not be amiss. The tires are placed in the chamber shown, top lid is closed, and pressure put on the ram. The ram is 22 in. diameter, and has a hydraulic pressure of 1500 lbs. per sq. inch. The steam pressure used is 40 to 50 lbs. to the square inch. The stroke is 12 ft. 1 in. and the top lid is arranged with a special breech block lock for quick handling. The machine work necessary on a vulcanizer of this nature is easily seen by reference to the sketch.

The planer job shown at Fig. 7 is one of rather decent size. It is a motor bed plate for a 400 H.P. rubber mill line, and the base of the piece is approximately 7 ft. square, the height being almost 3 ft. As will be noted there are four heads to the planer, and use is made of all four whenever possible. In the picture shown only two are being used. The bottom is first planed, then it is turned over, and top is completed. The piece is next turned round and the edges planed. This bed plate is made of cast iron, and the job is completed in approximately 30 hours.

Another interesting photograph is that at Fig. 8, this view showing an assortment of tire moulds. This concern makes practically any type of mould, but the style shown is a collapsible core, for straight side tires. Note that the

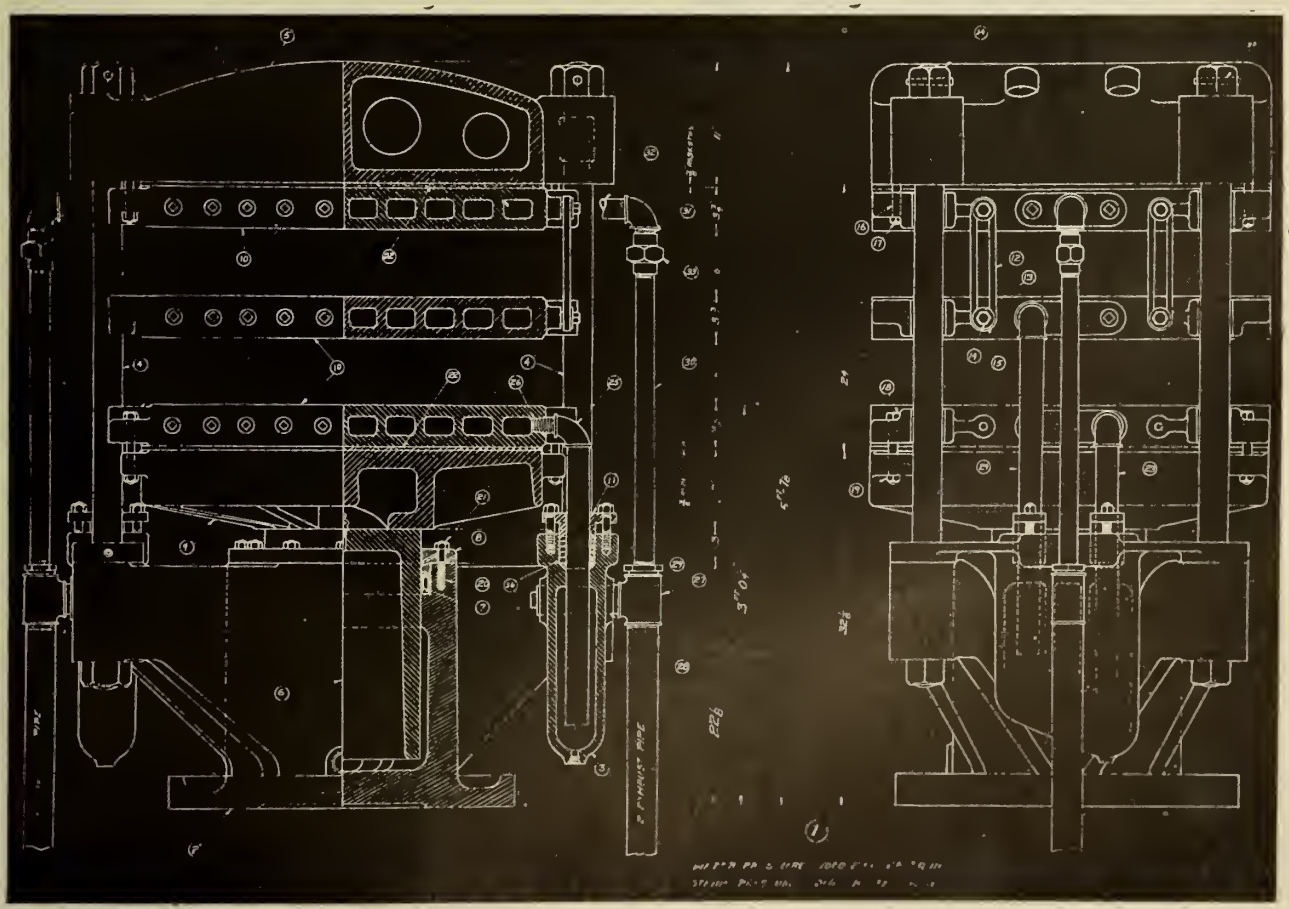


FIG. 9—A 75-TON 36" x 36" HEATER PRESS RECENTLY COMPLETED.

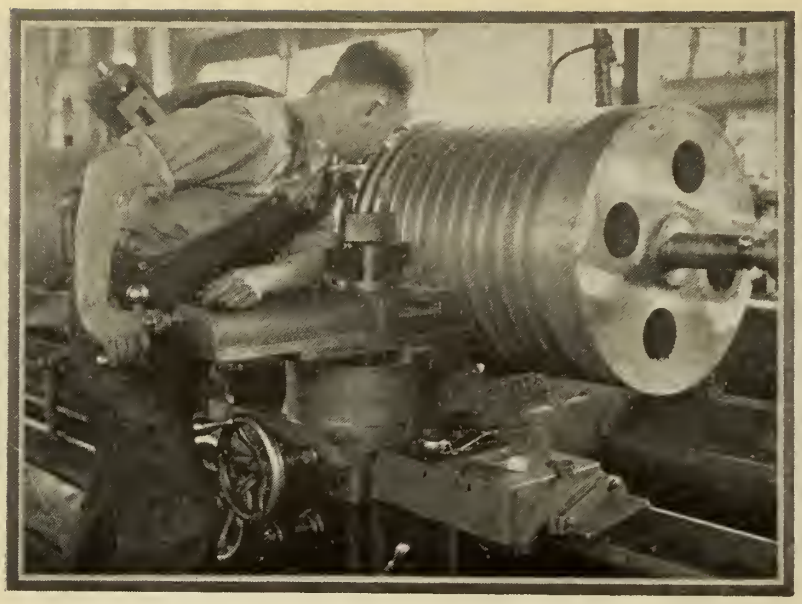


FIG. 10—MACHINING A BEAM ROLL FOR WIRE ROLLING MILL.

ring with bolts holds the two sections together. The machine work on one of these moulds is self apparent. The majority of the operations are completed on vertical boring mills, and of course all work is held to templets. This concern also does considerable tire mould engraving, and the engraving machine used is of unique design. Any style of tread can be arranged for, and engraved into the mould. Some very interesting treads were shown the writer, and the information was given him that there was not any impression they could not do on these machines.

The next illustration, Fig. 9, depicts a 75 ton 36 in. x 36 in. heater press. This has two six inch openings, and the steam platens are so designed as to be interchangeable. This means that only one spare platen is required in place of the regular three. The steam chests are also interchangeable, and this press has a water pressure of 1,000 lbs. per square inch, and a steam pressure of 40 lbs. per square inch. The steam of course is used to keep the platens up to the correct heat for vulcanizing. They are used for various kinds of rubber goods, in addition to bead molds for tires, and this short description will be sufficient for illustrative purposes. In conclusion we will generally summarize the varied class of work going on at this plant.

Fig. 10 depicts the machining of a beam roll for wire rolling mill. These rolls are 24 in. in diameter, 11 ft. 8 7-16 in. overall, and have 66 grooves and 15 ribs in their finished state. The grooves are 1 11-16 in. wide and the ribs 5-16 in. wide. The very fact of these ribs being so narrow necessitates great care to prevent the breaking of the same during the process of machining. The grooves are 1¼ in. deep, so that considerable machine work is necessary.

Following is the method adopted in the machining of these rolls. The first operation consists of taking a roughing cut across the complete roll when it is now removed from the lathes for the purpose of balancing. It is placed on straight edges for the purpose, and is balanced by means of sticking clay on the light parts. After sufficient clay is placed on the necessary portions of roll it is weighed and the amount of offset computed to balance roll when turned. When this is done, the center is drawn over, the work placed in the lathe once more, and turned to within ⅛ in. of its finished diameter.

A square nosed tool is next used to rough out the 66 grooves, these being cut down 1 3-16 in. deep. The steady rest is placed in its correct position and the ends bored out. First, the hole is bored for bearing spindle at the carriage end, after which work is reversed and used with steady rest at end as before.

The remaining end of work is now bored out, and the regular bearings driven into place. After the first side has been bored, the regular center at headstock is knocked out, and replaced by a bell center of suitable shape to accommodate hole previously bored.

The bearings being driven in, the work is completed on centers as shown in the photograph, and all grooves are carefully finished. This work is also accomplished on a 33 in. Le Blonde lathe.

TURNING OUT SMALL MOTORS

Continued from Page 587

The work performed is the punching and blanking of field cores, and one of the completed disks is shown at A. The punching, taken from the centre, is shown at B, while C depicts an assembled field core. Both the die blocks and punches are made solid in this case, but of course the four small punches are separate as can be noted. The same style gauge is used, and the procedure of making the die being the same as already described, we will pass on to Fig. 13.

Fan Punching Die

In the make-up of the Hoover suction sweeper, there is a fan used to keep the motor cool. The die used to punch out this fan is shown at Fig. 13. This is an intricate piece of punching, and each of the web-shaped punches A are made separate. The centre punch in this group is of course also a separate punch. The blanking punch B is solid, as is the die block itself. A completed punching is shown at C. Following up this fan, let us refer to Fig. 14.

To the left of this picture is depicted the die used to form the blank made at Fig. 13. A represents the punch, with pilot attached, B the forming die. At C is shown the flat blank, D depicts the formed fan, while F shows this fan mounted in its hub. The punch for forming is made solid, but the pilot punch is separate. As before, the die block is solid. The forming portions of the die operate from a spring stripper underneath the lower bolster plate. The action can of course be understood. The blank is placed on the die, down comes the ram and the stock must naturally form the punch and die, being formed to the shape shown.

The die to the right at Fig. 13 shows the equipment used to complete the contact arm of a motor. One of these arms can be noted at F. The peculiar shaped main punch measures approximately 2 5/32″ across, so that this measurement will allow readers to form a good idea of the proportions of the rest of the die. The smallest punches on this die are only .050″ diameter, and the others are 3/32″ diameter. There are also 2 oval punches as can be noted. The work on this piece is rather delicate, and mechanics can appreciate the fun in making punches .050″ diameter, not to speak of the tempering of the same.

Having touched on some of the important dies as used in this class of work, let us in conclusion consider the life of such dies. Take for example the die shown at Fig. 5. Here we have a double armature die of intricate design, yet 12,000 to 16,000 punchings can be made between grinds. The life of the die is clearly shown at Fig. 9 and a very conservative estimate could be placed at around the one million and a quarter mark. Some dies are ground from seventy to eighty times, or in other words, reduced from their original 1⅛″ thickness to ⅛″ thickness. The solid punches have also been found to stand up in like proportion. Such figures tell more than appears on the surface, and although the small clearance of .003 per side is not universal practice, it is the very fact of their using this clearance that makes for the long life of the die. Were the clearance greater the die could not be ground as far without affecting the character of the work. The experiences stated herein are definite and authentic, and deserve careful consideration.

Taking the *Dust* Out of *Industry*

Rewarding Honest Effort Is the Basis on Which Success Can Alone Be Secured—How One Firm Is Dealing With Matters of Employment, Good Conditions and Fair Pay

WHEN a person mentions bonus systems to encourage production there comes to the mind the history of the old piece-rate work, and there are not a few people who make a face when that is mentioned. The old piece-work shop was a queer proposition in some ways, and even yet it is hard to figure out how some of the men who operated them convinced themselves that it was good policy to set a piece-work rate, and then, when a worker got to the point of efficiency where he could pile up a decent pay envelope, cut the rate and start him all over again.

Well, a real bonus system is a different thing; at least it is in the shop of Robbins & Myers at Brantford. This firm has been making small motors at the parent plant in Springfield, Ohio, for a long time, and in March of 1920 they were ready to start operations in the Canadian field, following out here many of the ideas and plans that had worked successfully in the other place.

Robbins & Myers believe in bonuses. They believe in paying for service rendered. They believe in their employees making good wages, and they believe in keeping their hands as long as possible. But at the back of all this is the one thing that makes the rest possible, viz., when they set a price on a piece of work, they will not cut that figure because an operator or a mechanic can make good money. The only thing that would lead to the change in a price is when the operation is changed, or where it has been found in actual practice that the price on a new piece of work is at fault.

Mr. Roy Booth, the manager of the Canadian plant, makes this point very clear: "Were we to cut a price that we have set, our whole system of bonuses would go to pieces, and the employees would lose confidence in us." That, in brief, is the way he regards the bonus plan.

"In the old plan of day work, and often in the old days of piece-work, people did not know what their product cost them," continued Mr. Booth. "You know what used to happen in the piece-work. An employee would study every movement and cut out every detail of waste in the operation, and by hard work he would become so efficient that his wages would grow, sometimes over that of the foreman, or many of the people in the lesser executive positions. Instead of patting that man on the back and telling him to go ahead, there used to come the cut to a figure that would make it a killing job to make a decent wage. The idea was wrong, all wrong, and the wonder is that even yet we have some shops that follow this practice."

Pay for Production

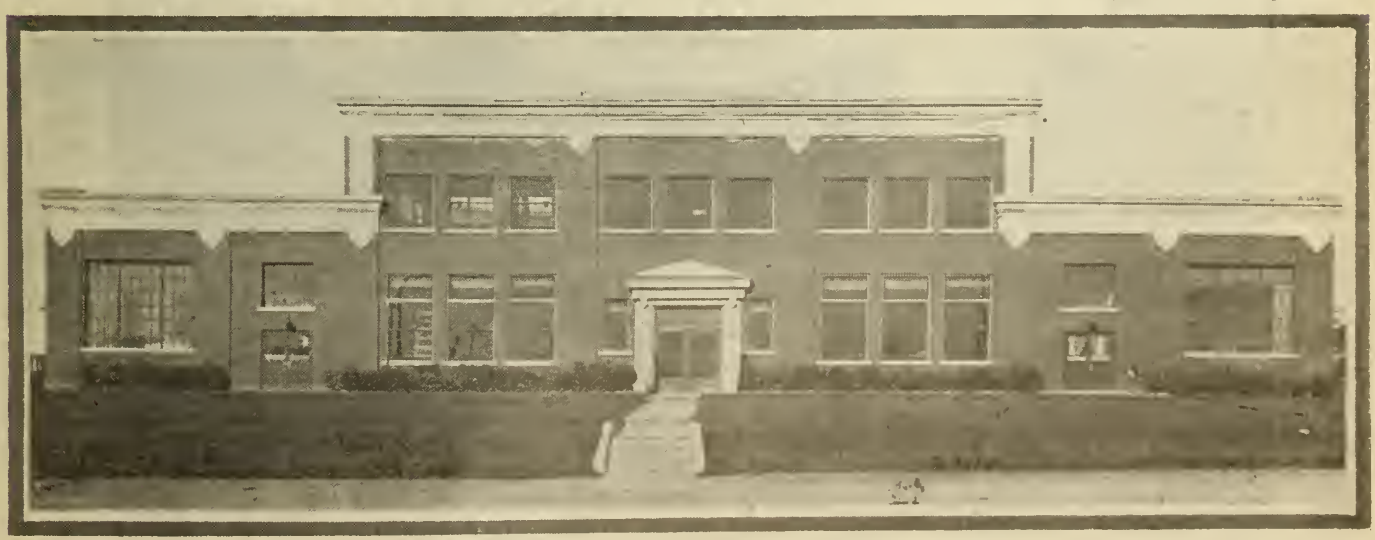
The Robbins & Myers plan of pricing work is reasonable. There is nothing that points toward the sweat shop tactics. For instance, if 60 units is a fair amount of work for an hour, and if an operator, after becoming skilled, can put 80 or 100 or 120 units of work into the same period, is there any good reason why the reward should not increase in proportion? None that we can see, and the Robbins & Myers people figure it out the same way.

In the making of these time standards, care is taken to be reasonable. The operator who does the work when the time is being taken on the piece knows that he is being timed. Then the same operation is timed again, and allowance made for the delays that invariably come. The standard set is aimed at being as near reasonable as possible, and if there is any work where it can be shown that the rate is not fair it is reconsidered.

When, for any reason, that the operator cannot control, production is held up, the company pays for the time on the basis of the 60 units.

There are Exceptions

Just a few weeks ago some new stock was taken in. In this case it was largely for grinding and drilling. The stock that had been in use previously was particularly good and there was a uniformity in the steel that made it very easy on the tools. When the new stock was put in a change was found. It was a different thing. The steel was hard, and a person working there could hear the tool grinding and cutting as on a piece of flint. There was need to take the tools to the grinder more frequently, and there was quite a difference in the speed



THE CANADIAN PLANT OF THE ROBBINS & MYERS CO., AT BRANTFORD. ALTHOUGH THE BUILDING HAS BEEN COMPLETED ONLY A SHORT TIME, SPLENDID PROGRESS HAS BEEN MADE IN BEAUTIFYING THE GROUNDS AT THE FRONT, FLOWERS AND SHRUBS MAKING A PLEASING SHOWING.

with which the operation could be done. That was adjusted just as soon as the operator and the foreman found that there was a change in the steel from the quality used when the work was timed in the first place. A new timing was made, and it will remain there until the harder stock is run out.

The Inspection Department

Well, if the rate is good, and there's plenty of work, why not steam ahead and get rich? Simply because there is an inspection department on the job to see that quality survives along with quantity. There are the floor inspectors and the bench inspectors. The floor inspector has to see that work is being made according to drawing, and that end comes under his notice. He is paid on the output of the department—that is, his bonus rests on that. But of course neither he nor the workers in the department are paid for work that is rejected. Then the bench inspector has a peculiar undertaking in that he is paid more for detecting a poor piece than he is for passing a good one.

"Well, hold on," I broke in here, "will that not mean that a bench inspector would be in a poor way financially were the work of the whole department brought to such a high standard that there would be very few rejections?"

"It might work out that way were we to let it go at that," replied Mr. Booth, "but we look after the bench inspector in other ways, and he is not allowed to go poor because there are few rejections. It has been our experience that the system brings the operators, the floor inspector and the bench inspector together to get the best results for all, for it is in completed and accepted work that the payment is made. There is very little work thrown out now, and very seldom is there any dispute over the matter. I am certain that I have not been called in to settle any such matters since the establishment was opened in Brantford."

The Securing of Help

Do they have trouble in securing help at the Robbins & Myers plant? They do not, and neither did they when help was scarce some months ago. The situation was not quite similar then to what it is to-day, when men and girls are looking for work. At the start of the year they were in need of help. They were not known in this country, and people who might be looking for employment were not "sold" on their shop. They are now. But to get back to the start, Mr. Booth practically tapped a new labor market in a new way. He wanted girls to work principally in the winding department, and he advertised. But he did not stick in a little two or three line ad. stating that they wanted a number of hands. He went about it in another way. He stated in his advertising matter that his firm would be ready to commence work in a short time, and that girls desiring to secure employment should call and receive an employment application form, which they would be required to fill in, and on this they would need the signature of two reputable business men certifying to the standing of the applicant for employment. Did the girls in the community resent this? Not a bit of it. They came along with their application forms, and they secured employment, and, what's more, they liked the place, and stayed with it. In the little strip photo published elsewhere in this article are some of the first girls who came with the Robbins & Myers plant. Some of them have left since the photo was taken, but they had very good reasons for so doing, and their leaving only goes to show that no matter how good your system of employment and treatment, it is liable to be broken down now and then. Dan Cupid is the chap who made the break here and the girls are now keeping house in Brantford.

Largely Skilled Help

Now don't get the idea that girls form the majority of the help employed at the Robbins & Myers plant. They have a highly organized plant for the manufacture of small motors, and in it have a large number of highly trained men, and it is through all the plant that the system of bonus and other forms of reward is in operation. The firm operates an open shop, but there are union men working in it.

Mr. Booth, as far as one can judge, can see no difference between the office and shop, and the chances



THE CAFETERIA IS SELF-SUPPORTING, BUT NOT A MONEY MAKER. THE REST ROOM IS A QUIET, COMFORTABLE SPOT, MODESTLY FURNISHED.

are that this doctrine is pretty well understood around the whole premises, and after all his way of figuring it out is right. Here it is:

"Every operation that goes on in this plant, whether it is in the office or the shop, or on a truck, is necessary. That is the point from which we start to work, and we try to keep before every employee the fact that all are needed and all are necessary, and that one department cannot get along without the other. We are succeeding in doing this, and there is not a regulation that applies to the shop that is not in force in the office."

I remember being in Mr. Booth's office some months ago when one of the employees came in and told him that a number of them, from either the office or some corner of the shop were having a corn roast that evening and would like the use of the cafeteria for a dance after the corn roast.

"First rate," responded Mr. Booth, "by all means have your corn roast, and by all means have your dance after it."

The employee thanked him, and was just about to withdraw, when Mr. Booth started in again: "But remember this, that when you come here and open the cafeteria for a dance in the evening, it is open to all the employees of this company and not to any particular few. If others who are not invited to the corn roast happen to be along here during the evening and see the cafeteria lit up and ready for a dance, it must be understood that they are just as welcome as the party holding the corn roast."

The corn roast was held and the dance was held, and, in the words of the country correspondent, "a good time was had by all."

It Pays do Do These Things

The Robbins & Myers Co. believe in time clocks—in fact they are all clock punchers. There may be some who escape, but I have not heard of it. And the strange thing about it is that they are keen to punch the clock, four times a day. It pays them to do it; not that they are penalized for not doing it, but rather they are rewarded if they attend to this promptly.

There's a bonus for the punchers, and the good punchers can punch out a five per cent. bonus for a week's good performance. So if a girl makes $20 a week she can add a dollar to it by simply punching the clock promptly morning, noon, and night. If a mechanic makes $30 he can add $1.50 per week in this very simple manner.

"And what per cent. of the employees are bonus punchers?" was asked.

"Oh, at least 95 per cent.," was the answer. "We make no allowance on this, and there are no excuses accepted. I remember not long ago that one of the officials here stayed until 6.30 in the evening talking to a customer from out-of-town. When he went out he forgot to punch the clock and it spoilt his week. But we have to make a hard-and-fast rule in this matter, because once it becomes known that there is a single exception made to it, your whole system is off and done for. The bonus for a perfect week is paid on the total earnings for the week, including any production bonus that may have been earned."

And the company admits that it pays to take this positive measure of rewarding good attendance rather than by taking the negative view and penalizing for slow arrival, and the result is that the employees are all on good terms with the time clock.

Then There's a Service Bonus

The Robbins & Myers people are anxious to do away with their labor turnover as far as possible. In their line of work, as in many others, the longer a person is with them the more valuable they become, and the more the company desires that they should continue. In order to get this they use a service bonus. It's not a complicated piece of business, and works out something like this:

When an employee has been with the firm for six months his bonus starts, and at that time it is 1½ per cent. of all the money he has earned in the previous three months. This keeps on until at the end of five years, the increases coming every six months, the employee finds that ten per cent. of all earnings in each previous six months are handed to him in a lump sum. This bonus includes ten per cent. on everything, even to the five per cent. bonus that is paid for prompt attendance and punching of the clock.

"Well, does it pay to go that strong?" was asked of Mr. Booth.

"There's not even room for an argument about it," was the answer. "It has almost eliminated our labor turnover. It holds our employees here, no matter how hard other firms may try to get them. We know how our wages compare with others paid in various shops here, and when there is, after five years, a ten per cent. bonus every three months, do you think any man or girl

A Word About Mr. Booth



ROY BOOTH.

Roy Booth, works manager of the Canadian plant of Robbins & Myers, Ltd., is not a theorist alone. He knows what a fair day's work is, because at the age of 15 he started as an apprentice with the Dayton Brass Co., where he served his time, upon completion of which he went as a bench mechanic to the American Tin Can Co. Entering the plant of the Dayton Computing Scales Co., he worked up to the position of assistant superintendent, and in 1908, when the branch was started on Vincent Square, Vauxhall Bridge Road, he was placed in charge. In 1910 he came back to the Dayton plant, remaining with this same company until 1917, when he entered the employ of the Robbins & Myers Co., at Springfield, Ohio, first as chief inspector, then as assistant electrical superintendent. In September of 1919, the company informed Mr. Booth that he was to be the man to head their peaceful invasion of this good land to the north. Work was started on the Brantford plant in October of 1919, and in nine months the plant was complete, machinery placed and running, a staff trained, and production of 150 motors per day was secured.

Mr. Booth is making a pretty fair Canadian. He can't swallow his accent yet and it continues to come to the top of his vernacular. Rotarians and other good chaps at Brantford have taken kindly to him—they like to have him about and vote him a good citizen. His wife holds much the same views and two young Booths claim the privilege of calling him Dad. He likes Brantford and Canadians in general, and it looks as though he were planted up here for keeps.

is going to pass that up without a little more than passing thought?"

Come to think of it, the thing works out to a nice little item. For instance, suppose you were working for the Robbins & Myers Co., and had been there for five years, and were receiving the ten per cent. bonus. Your wages are, supposing again, $40 a wook—not an unlikely figure—that would be for thirteen weeks, $520. Forget the clock bonus for the time being, and think only of the $40 a week. Well, around Christmas, or around anything else for that matter, it would not be a bad sensation to have an extra cheque coming across for $52, and it would be a still more pleasant sensation to have this happening every three months.

This service bonus applies to every person in the establishment, office, tool room, winding department, shipping, trucking, etc.

Some Ideas of His Own

Mr. Booth, the Canadian manager, has some ideas of his own in regard to the handling of a staff, and I remember quite well that on one occasion he discussed this matter, although he was not speaking for publication at that time. But the idea is a good one and worth repeating:

"I do not like to see a man leave here, and I dislike still more to see a man or a girl discharged. We try to find a place where they can make good. I make it a point to see every person myself who is leaving our employ. There are cases where men leave machine shops and foundries because they are not getting a square deal from the foreman. I have run across just such cases; not here, but in other works. A workman may be 'in wrong' with the foreman, and it is a very easy matter for the foreman to give him all the lean jobs if he is on a bonus basis, and make it almost impossible for him to get ahead and make money. If a man leaves this establishment for a fault that is not his own, I think we are entitled to find out just where the trouble is, and if it is ours we want to set it right, and if it is his we want, if possible, to set him right. A great deal can be accomplished with a little good sense and reason, and the more you deal with men the more you should know about them. There are often cases where a man will not take his complaint over the head of the foreman or the superintendent: he will simply pass in his slip and fill out a quit card rather than make a show for it. He leaves, and gets work elsewhere, but he is very apt to entertain a poor opinion of our works, and this can be very easily spread. When this is going on to any great extent you cannot keep the community 'sold' on your shop being a good place in which to secure employment."

Every employee who takes employment with Robbins & Myers is insured with no cost to the individual under their group insurance system. It starts at $500, and increases $100 each year until a maximum of $1,000 is reached. If, through illness, the employee has to leave work, the insurance continues, and will be carried, if necessary, for a term of twenty years, provided of course that the insured person does not accept employment elsewhere in the meantime, in which case the insurance ceases. This insurance feature is a popular one with the employees, as they are glad to get the added protection and are apt to think seriously before leaving the employ of a shop extending them this amount of free protection.

Some months back now it was decided to put in a cost-plan cafeteria. The building was constructed with this in view, and the cafeteria is over the office. The floors are of hardwood, highly polished and waxed with a view to using it for dancing purposes. The tables and chairs are so made that the entire floor can be cleared out.

"Make much out of the cafeteria?" we asked.

"Sure," laughed Mr. Booth. "For the first three months we were $7.93 ahead of the game, and I have just received the figures for the last month which show a profit of $1.96, and you know that could be very easily wiped out if one were to let the knife slip a couple of times in slicing up the ham at present figures. We post a statement every month so that all the employees can see it, showing what we have in stock, what we have paid out in wages and for provisions, and against this what we get in the way of receipts. This has worked out very satisfactorily, and we are able to keep the confidence of all in the prices that we charge for the service."

Then there is the first Saturday in each month. It may be known locally as Fox Trot Saturday or Barn Dance Saturday, but whatever the name, on the first Saturday evening of each month the company opens the cafeteria in the evening for the employees to have a dance. They can bring along their friends, apparently the more the merrier. Where does the company come in? They do everything but dance. They provide the dance hall, the music, the cake and the coffee, and it is not on record yet that they have squealed about the number of friends that any employee leads out. The office staff and the shop mix freely at these gatherings, in fact there is no distinction one way or the other.

Sports are encouraged, and the Robbins & Myers team won the soft ball championship of the city in 1920. There is a clean, wholesome air about the whole place, and the evident desire of the company is that its employees shall make a good living and have a fairly decent time while they are doing it.

Judging a Wheel

We often hear the query what is a hard wheel and what is a soft grinding wheel. These terms are rather confusing and are not really comparative terms.

A wheel may be too hard for one job and too soft for another. If a wheel is too hard for one job, its bond insists on holding onto the abrasive particles after they have lost their sharpness or cutting power. Such a wheel is very inefficient and will glaze badly. If the wheel is too soft the abrasive particles will break away from their setting in the bond before they have lost their cutting power. Such a wheel wears away very rapidly, but on the other hand, it cuts very well. The ideal wheel is the wheel with a bond that permits the abrasive particles to drop off and expose new particles just at the point where the old ones become dull. With the wide variety of grits, grades and bonds manufactured, it is possible to purchase a wheel with just the right characteristics for most any job.



THESE ARE THE FIRST GIRLS COMING TO THE ROBBINS & MYERS PLANT WHEN OPERATIONS WERE STARTED. EXCEPT FOR MARRIAGES THEY ARE STILL WITH THE COMPANY.

Works Council After *Two Years'* Trial



THE INTERNATIONAL HARVESTER COMPANY OF CANADA, LIMITED. — THE LARGEST AGRICULTURAL IMPLEMENT WORKS IN THE BRITISH EMPIRE

ALMOST two years ago the International Harvester Co., Hamilton, started the Industrial Council plan in their establishment, doing so on a favorable vote of the employees. Their evidence in the matter is valuable now because it has the weight of real experience behind it. Canadian Machinery found officials of the company very frank in discussing the system, and anxious to give other manufacturers the benefit of the experience they have had in this direction.



MANUFACTURERS are trying to find some plan that will put the "US" into indUStry. The men in the shops are ready to meet this idea half way. No man likes to feel that he is working in a shop, and yet is not part of it. There is something in the make-up of the average person that calls for a "say" in the conduct of anything that he is connected with. When one can satisfy that feeling, and link up with it a force that will actually make a man a better and more competent workman, then the chances are that you have something worth while.

Now that's just about what the Industrial Council is doing. It is not a matter of theory any longer. The average manufacturer or employer is not much impressed with theories now. He has seen too many of them flivver —but he is interested in anything that will work when it is put up against shop conditions for six days a week. The Industrial Council started as a theory, and it is now established as a fact. The International Harvester Co., at Hamilton, have been operating under the Industrial Council plan for almost two years, and they are willing to continue it. Nor do they hide their light under a bushel. As you enter the premises at Hamilton you are informed, by means of a large notice, that this establishment is operated under the Industrial Council Board, and when you reach the large offices upstairs there is another indication in the form of a commodious board room, devoted to the affairs of the Industrial Council.

The International Harvester Company believe that this system has gone past the experimental stage. They are willing to admit that it is a success, and are satisfied that conditions are better all round. It is almost two years since the plan was inaugurated. The secretary of the Works Council devotes his entire time to its working, and he has plenty to keep him busy, for the work grows in new directions every month, and the idea of "doing things" seems to be breaking out in new places all the time.

Here's What It Does

If you had a system in your shop that would make a mechanic a better mechanic, or that would cause a moulder to be a better moulder, don't you think you would be satisfied that you were working along the right lines? Well, there's no revolution going on at the Harvester plant, but it is a fact that the work that is being done through the Industrial Council plan, is doing this very thing. For instance: Some dispute arose in the foundry about the rejection of castings, and the matter was taken up at once by the elected representative of the men in that department. But it never got to the Industrial Council, nor is it recorded that there was even a special session about the matter. How was it done? Simply this: The men in the shop looked into the matter, and they found that the work that this particular man had been turning out had not been up to the quality required by the firm. They went right to him and showed him how he could improve his work a great deal, and make more money by so doing. What happened? Why only one thing could happen. That moulder began right there and then to do better work, and that was the end of the complaint and of the whole matter.

The Works Council, if I get the thing right, does not aim to have a truck load of complaints and squabbles to deal with when it comes to its monthly meeting. Rather is it considered a good meeting when there are none of these matters to come before the board, and where the whole time can be taken up in planning new things and better methods.

Of Course There Are Wages

Canadian Machinery discussed the working of the Council with the Works Council secretary at some length, and in response to a query about the most-discussed thing dealt with, the answer came in the form of an admission that wages crowded pretty well to the top of the list.

"And can you come to an agreement about wages?" was asked, for it is a fact that hardly any man ever thinks he is regarded financially high enough by the firm for which he works.

"When we get together on this ticklish matter of wages," answered the secretary, "we find that the men are not unreasonable when they have all the facts placed before them. Of course we try to have as many real figures as we can when we discuss these matters, and it is our desire to bring our statistics as near correct as possible when we come to discuss the cost of living in Hamilton and else-

where, for that is what most of the demands for wages are based upon."

The secretary admitted that they did not accept the Ottawa figures, nor yet did they rely on the figures gathered by their branches in United States. "All these are good enough, but when our men are living in Hamilton, and keeping house here and buying their stuff here, this is the place where we must base our figures if they are going to have a real weight with the men, and going to be fair for all parties concerned."

And so the Harvester people took a very real way of finding out what it cost to keep house in Hamilton. They took a family budget, not one that a bachelor might think necessary, but a real one, worked out in the council from figures from real Hamilton homes, and they had the purchases made in the stores where their men dealt. The idea was to get as near as possible to real facts, so that when a readjustment of wages was made it would represent the real burden that was going to be placed on these wages when they were spent.

It took some little time to get this family budget brought as near correct as we wanted it, but in the end we found that the figures as worked out by the company, and the figures prepared by the men were just 38 cents a week apart for a family of five, so it was not a very serious matter to get over that difference."

Well, Not Yet

"Any cases yet that the Council have not been able to settle?" "Not yet," was the answer. "The principal thing in settling cases is to make sure that they go through the proper channels in the shop, especially to the foremen, before they are ever allowed to come before the Council. We do not want them brought in here for discussion or settlement. The Harvester Industrial Council makes provision for disputes being discussed in the shop and never brought in here at all, and we encourage that. Some of the men's representatives in the shops are very capable in the role of negotiators. We do not claim that there will not be questions coming up that we cannot handle, but we do know that more and more there is being created a get-together feeling in the works, and men who were hostile at the start, or luke-warm at least, are being won over to the proposition."

"Any particular instance of this, or just a feeling in general?" "Yes," went on the secretary, "here's a particular case. One of the foremen was very skeptical about the whole thing, and he was not in sympathy with the move. It may be that he thought matters would be carried over his head by the shop representative of the men. Well, we asked him to come in one day and attend a meeting. He did, and heard all the discussions that went on, and had an opportunity to see for himself what there was in it for the men and for the company. When the session was over he told me he was sold on the idea. He had not understood how it would work out before. Since then he has been one of its best friends, and does all he can in the shop to see that the Council has fair treatment there.

Feel They Are In It

"Let me put it this way," I suggested. "Are there any results now, that you did not look for when the plan was first put into operation?"

"One big one," was the secretary's opinion, "and that is the men have the feeling that they now have a say in matters around here that would not be possible in any other way. That in itself is worth a very great deal and something many manufacturers are very anxious to secure. There is nothing a man values more than the feeling that he is really part of the works, and has a voice in the direction of the concern."

Nor does the work stop here. There is a mile or so more things than simply attending to the conditions in the shop. Did you ever get a new job in a big shop in a strange city? Not a particularly desirable sensation sometimes. You wondered who the chap next to you was, and perhaps didn't like to ask him. You didn't know where things were, and you felt generally strange for a time. Well, how would you like to have some one come along the first morning and give you a hand shake, and make you feel at home—tell you the run of the place, and everything you wanted to know—make you acquainted with the man on the next machine, tell you where the cafeteria is, and give you an idea of the run of the day, and what was going on around the place. Not bad, eh? Or if you were laid up for a day or so, you used to wonder if your little old job would be waiting there for you when you got back, or if you'd have to start in again all over. Much better to have some one from the shop call at the house, and see how you are getting along, see if you are getting proper attention, see of there is anything they can do for you. Why, of course. Well, that's the sort of work the Council encourages, and when a body of men get headed in that direction it's hard to say just when or where they will stop.

The Cost Plan Cafeteria

The Harvester cafeteria is a busy and popular place at noon hour. Realizing the important bearing a hot meal has on the workers' health and efficiency, Works Council petitioned the company for space and equipment to establish a cafeteria, which they did, setting aside a large floor on one of the existing buildings, and installing a complete modern outfit, then the project was turned over to Works Council to operate for the benefit of employes. There superintendent and janitor are all served alike with a substantial plain hot meal, as well as cold service at cost, and

These Views Tell of Happy Days at Harvester Picnics





The Plowites' Band is an Ever Popular Organization





wherever it is found possible to reduce prices it is done at once.

The Harvester Company in all its plants has a benefit society to which both the employe and the company contributes. It costs the company something like $50,000 per year for this work in its various branches. A man is entitled to 50 per cent. of his wages when sick, and this will be paid for 52 weeks. In case of death the heirs receive the equivalent of one year's salary of the deceased.

They also have in operation a Pension Plan, the expense of which is borne entirely by the company, and which is purely a voluntary expression of the company's desire and purpose to stand by the men who have stood by it, not as pensioners, but as the company's old guard, who have well earned this reward for long and loyal service and are justly entitled to all that the company does to make their lives happy and more comfortable.

Employes are pensionable at 65 years after 20 years' service, at 60 after 25 years' service, and at 55 after 30 years' service. Women are pensionable at 50 after 20 years' service. Special consideration is given to employes whose age and service approximate this requirement, and who become totally and permanently incapacitated.

There there are other directions in which the Council find room to work. The first aid class is an efficient body, although fortunately their services are not called upon very often, as the works at Hamilton have been fairly free of serious accidents for some time. This may be partly due to the fact that suggestions are welcomed at all times regarding safety appliances, and improved methods for doing any operation. Directly across from the main office is the hospital for the works, where a doctor and nurse are in attendance.

The same committee that looks after the cafeteria, health, etc., have charge of such affairs as gardening and the beautification of the grounds of the homes where the employes live, and they hold to the belief that a man is a better workman if his surroundings out of the shop are bright, pleasant and congenial. During the last season there were some 275 garden plots provided by the company, in addition to a contest between all the Harvester plants for the best kept gardens at the homes of the employes, two Hamilton gardeners winning the third and fourth places. Other committees look after publicity for anything and everything that goes on in connection with the work of the Council around the plant, in connection with social gatherings, sports, picnics, etc. Very useful work is done by a committee that looks after the sick of the shop. A list of these is furnished to the committee, and a point is made at once of calling on them. The spirit of the thing is growing around the Harvester plant at Hamilton, and it does not take much imagination to see where the Council plant is going to grow into a good sized tree, well worth the space it occupies in the organization, and fully justifying all the watering, pruning and enriching it has received.

Real Suggestion Brought Out

But what is there of real help in the meetings of the Council. You must remember that the company pays the men for the time they spend attending these sessions, pays expenses if they find it necessary to make a trip, pays for the time matters are being discussed outside of the Council chamber. What comes in return? Well, a casting came back from away out in the west one day. It was broken, and the matter came before the Industrial Council. It wasn't simply replaced and the broken one put on the scrap heap at the foundry. The men responsible for the making of these parts had a chance to talk the thing over. One man believed that there might have been



Sports of all sorts are encouraged by the Harvester council, and here is seen one of the ladder stunts, in which a record was made that still stands.

some trouble in loading explaining how it could be done to avoid undue packing stress. Another was of the opinion that from the nature of the work, it should have been made from malleable in the first place, and gave reasons for stating that. Another had a suggestion to make about the design which might lend added strength to the part. Every suggestion that was made was practical, and worth money to the firm. Could all these suggestions have been secured and recorded in any other way? Not that we know of in so short a time and under such practical circumstances.

Again, the committee that has charge of health, safety and kindred work around the plant, bring in their report. Do they deal in glaring generalities, or do they have something real to talk about. Judge for yourself from this:

These recommendations were made to the superintendent, and the report given carries with it the action that has been taken:

The crane in malleable foundry be repaired, thoroughly overhauled, and put in good running order as soon as possible.—Ordered done and nearly completed.

Concrete floor in malleable sorting room be repaired. —Ordered done and completed.

Platform outside of malleable foundry be repaired.— Ordered done and completed.

Installation of air hoist over tumbling barrels in malleable foundry be completed.—Ordered and being done.

Hole in platform at dock be repaired.—Ordered and done.

Exhauster hoods for emery grinders in forge be pushed along.—Being moulded.

Crane for die rack in press room be completed and installed.—Ordered and drawings being prepared.

All telephone transmitters be cleaned and disinfected. —Ordered done.

Those instances are given to show that the men themselves, under this plan, are largely responsible for the conditions under which they work, and if there is anything that is not right, or that makes it an undesirable place in which to work, the remedy is in their own hands. There is nothing academic about the discussions. They are real and pertinent. If good they are acted upon, if not, they are considered and passed up.

How the Shop is Divided

The workings of the plan for selecting the members of the Industrial Council are similar to those published previously in this paper. The method of dividing up a shop for the purpose of giving proportional representation to each department is interesting. In the Harvester plant it is divided as follows:

Division 1.—Cold Drawn, Iron House, Steamfitters, Press Room, Forge Shop, Bolt and Nut.—277.

Division 2.—Grey Iron Foundry, Grey Iron Mill, Grey Iron Core.—284.

Division 3.—Malleable Foundry, Malleable Mill and Anneal, Malleable Core.—254.

Division 4.—Metal Pattern, Wood Pattern, Malleable Finish, Tool, Machine Repair, Fire and Watch, Electrical, Engineers, Experimental, Planning, Drafting.—273.

Division 5.—Wood, Canvas, Lumber, Traffic, Truck and Storage.—263.

Division 6.—Box, Erecting No. 1, Mower, Machine, Sheet Metal.—267.

Division 7.—Shipping, Packing, Repairs, Stock Room, Office, Production, Cafeteria, Yard.—251.

World Wireless Service

An extensive wireless service is contemplated between the French Colonies and the Mother Country. The scheme, according to Wireless World, is divided into four sections. The first section, which aims at providing communication between ships at sea and coastal stations, is already working satisfactorily, but further extensions will be made. The second section will be used to maintain regular communication with the mountainous regions, which, owing to the weight of snow invariably bringing down wires, are out of communication during the winter. The coastal system will ensure communication between France and islands round the coast; it is hoped also to link up Algiers with Paris. The third, or Franco-European system, is already started, wireless communication having been established since May with Hungary, and it is hoped shortly to open up communication with Belgrade also. The fourth section covers the linking up of the French Colonies, including Saigon, Noumea and Tahiti, with France. Stations with a transmitting range of 7,500 miles will be erected at Paris, Saigon and Tahiti. Less powerful stations of about 4,300 miles range will be constructed at Jiboutil, Antananarivo, Noumean and Martinique. Smaller stations will link up the French Possessions in Africa, connecting Martinique with French Guinea and Saigon with Pondicherry. The Ministry of War has already begun the construction of stations in the French Congo, Anatanarivo and Saigon.



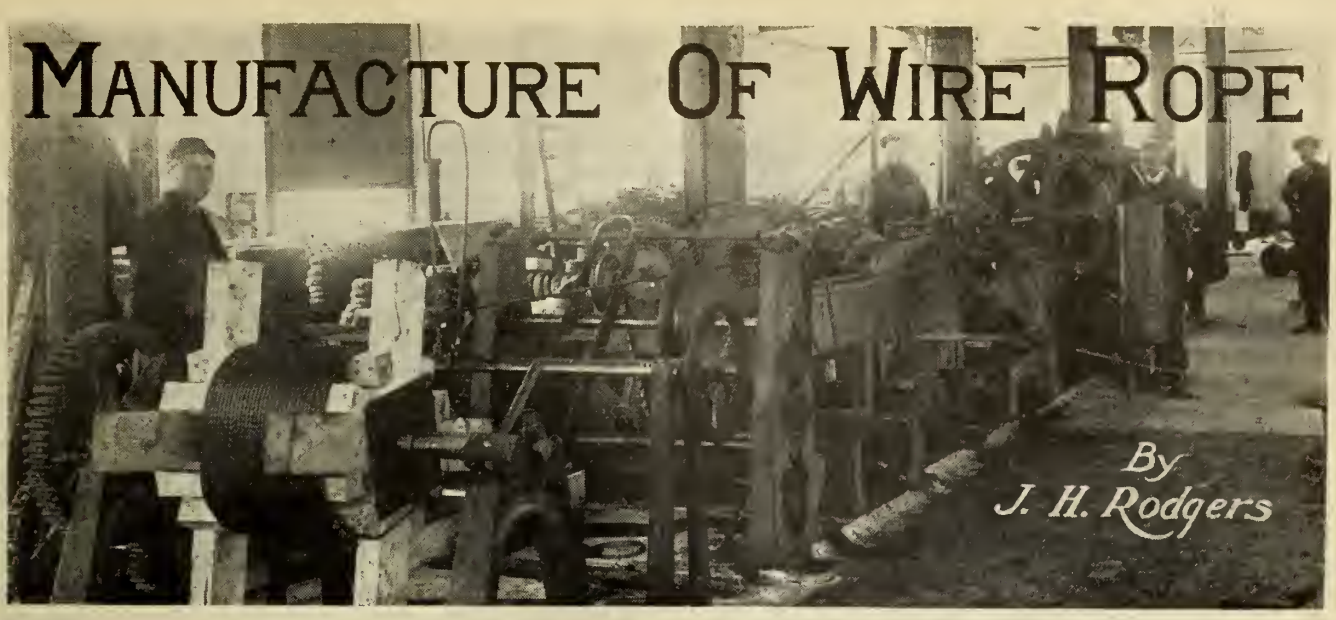
THE LOOK-UP MAN

If you are away from sickness or any other cause, they don't just wait for you to come back. The look-up man is sure to call and see what's wrong and how you are being attended to.



The hospital at the Harvester plant is in a separate building and the services of a doctor and nurse are always available. Through the efforts of the council, accidents are being reduced in the plant.

MANUFACTURE OF WIRE ROPE



By J. H. Rodgers

THE first requisite in the manufacture of wire rope is the selection and blending of the different iron ores. The different processes through which the metal passes, and the hammering and drawing into rods require great experience, and give to it peculiar properties that are essential for the finished product. The story to follow tells how the Anglo-Canadian Wire Rope Co., Limited, Rockfield, Que., manufacture their line of rope, this varying from the smallest wire rope up to cables 1¾-inch diameter.

The care necessary regarding the selection and blending of the iron ores is equally needed in the annealing and hardening processes, during which the wires are drawn through dies to the required gauge. It is very important that the operation of drawing be performed at a uniform speed through the entire length of a hank of wire, otherwise there is a great possibility that the strength of the wire will vary at different points. After drawing the wire that is used for certain duties is subjected to special processes of galvanizing in order to make it proof against atmospheric and other influences. Experiments have shown that when the first wire in a rope breaks, it may be assumed that the rope has passed through one-half of its life, and as no one knowingly works a rope until it breaks entirely, then the breakage of a few wires is a sign that a rope should be carefully watched and replaced by a new one at the earliest opportunity.

Various Types of Ropes

The flexibility of a wire rope depends upon the number of wires of which it is formed; consequently the use to which a rope is to be put will partly determine the number of wires used in its construction. In some cases nearly 400 individual wires are employed in making one rope. Fig. 1B shows in section some of the types of construction, the particulars of which are as follows:—

1.—Laid rope of 6 strands of 7 wires each. This is the class of rope most frequently used for hauling ropes, where the size of the drum and sheaves will permit; it is also the make of rope in general use for standing rigging, and is such as is required by Lloyd's regulations.

2.—Hauling rope made of 6 strands, each being of 7 wires covering 7 smaller ones.

3.—Hauling rope made of 6 strands, each strand made of 8 wires covering 7 smaller ones.

4.—Hauling rope made of 6 strands, each strand made of 10 wires covering 7 smaller ones.

5.—Formed rope made of 6 strands of 19 wires each. In larger sizes this make of rope is used for standing rigging on vessels. In smaller sizes it is sometimes used for running rigging, and it is the usual make of rope for travel warps.

6.—Flexible steel rope made of 6 strands each of 12 wires with hemp heart and hemp centre in each strand. This is the usual make of flexible steel wire rope 4½ inches in circumference and smaller, used for hawsers, running lifts, hoists, etc.

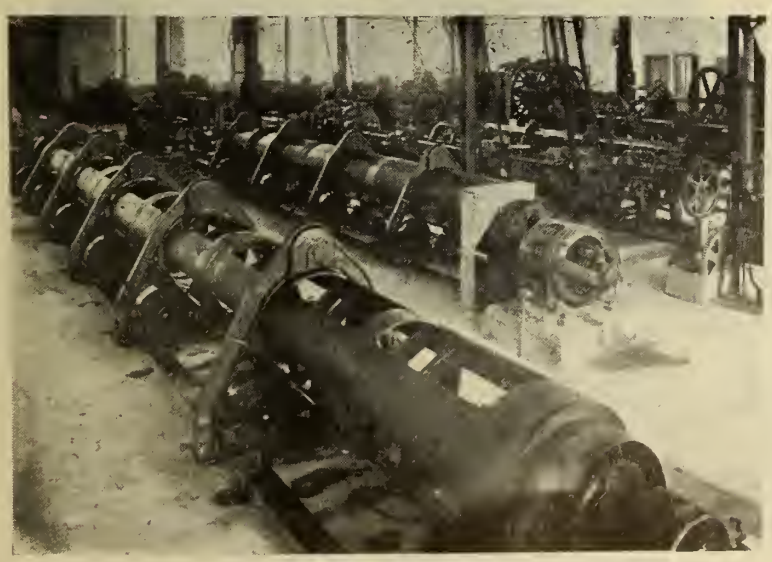


FIG. 1—GENERAL VIEW OF MACHINE SECTION.



FIG. 2—HIGH SPEED STRANDING MACHINE. DRAWING OFF GEARS IN FOREGROUND.

7.—Extra flexible steel wire rope made of 6 strands of 24 wires each.

8.—Special extra flexible steel wire rope made of 6 strands of 37 wires to the strand.

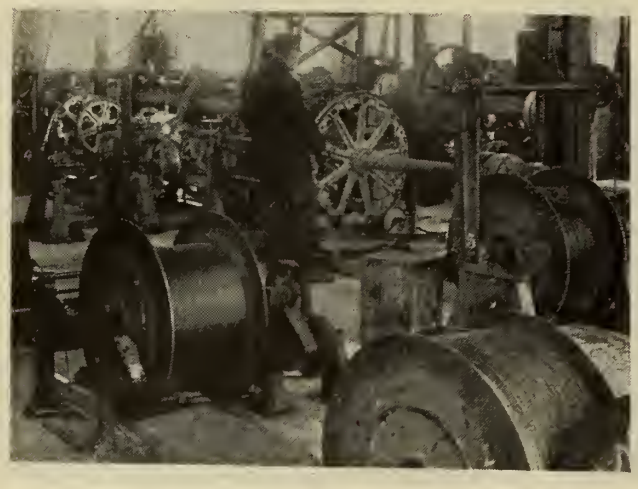


FIG. 3—SMALL TRIPLE STRANDING MACHINE.

9.—This is the make of rope usually adopted for large ropes—say over 10 inches in circumference—largely used for slipways and salvage purposes.

Testing the Wire

At the plant of the Anglo-Canadian Wire Rope Co. every bale of wire is subjected to rigid test before it is allowed to be worked up into rope. Before the wire is reeled on to the bobbins a short piece is cut from each hank and given a physical test to determine its torsional and tensile strength. The test for torsion or twist is made in a small hand machine similar to that shown in Fig. 1A. The bed of this machine (which is located on a bench) is graduated into inches, so that the length of the section of wire under test will be indicated by the setting of the front end of the tailstock A. The spindle of the tailstock is so fitted that it will not revolve, but has a short endwise movement to accommodate the shortening of the wire when twisting. The two springs B are provided to keep the spindle in the extreme open position. The hollow shaft allows the wire to be run through from the rear so that it may be secured in the two chucks C and D. The fixed headstock E is fitted with a revolving spindle, operated by gearing F and the crank G. To the middle of the spindle the worm H is secured, which meshes with the worm wheel I, fastened to the vertical shaft that carries the indicating dial J, each graduation representing one turn of the spindle and likewise the wire.

Making Strands on "Snake" Machine

Fig. 1 shows a general view of the machine section of the plant, with two "snake" stranding machines in the foreground. These two stranders working conjointly are capable of turning out the standard 19 wire strands at the approximate speed of 300 feet per minute, the barrel of the machine having a maximum speed of 500 revolutions per minute. Every machine is operated by individual motor drive and the controller is located at the drawing off end of the machine where the operator stands. Fig. 2 shows the finishing end of one of the "snake" machines, with the gearing that is necessary for drawing off the completed strand. The speed with which the strand is pulled through the dies, in relation to the speed at which the machine is revolving, determines the length of lay. This factor of lay, or helix, is the fundamental essential in successful rope making. This is especially true when strands are composed of more than seven wires. It is very important that "crossing" of the wires in a strand be avoided, as this will cause excessive stress and eventually result in a weakened or broken wire.

The "snake" machines are of the most modern type for making the strands, as they are capable of being operated at high speeds, accelerate rapidly, and are quickly stopped when the occasion arises; suitable braking facilities being provided and always under the control of the operator when standing in a working position. These machines have no central shaft, the revolving section being in the form of a hollow drum, open at intervals to permit of inserting and removing the bobbins, and threading the wires through the various rollers to the forward end, where they all converge toward the centre wire, around which they are twisted and thence pulled through the die by the action of the drawing-off gear. The revolving portion of these machines is made of cast iron, and built up in sections, rigidly secured together to form one continuous hollow drum. Within this drum, and uniformly located, are the suspended cradles which support the bobbins.

The wire from the bobbins is passed through a number of small pulleys or rollers supported in brackets secured to the inner surface of the drum. Plenty of space is allowed in the groove of these rollers so that the movement of the drum permits the wire to swing about the centre, but without any perceptible twist until it reaches the front head. Each bobbbin is controlled by a brake which acts as a tensioning device, so that equal strain can be applied to each, allowing the wires to unwind uniformly. If the tension is insufficient there is a possibility of the wire buckling, and if too great there is danger of the wire breaking.

While the run of wire is generally of such a character as to permit of uninterrupted operations for long periods, it sometimes happens that a wire will break when the strand is being made. This necessitates immediate stopping of the machine. If the wire breaks before the twist is made, it simply means that the ends are prepared and placed in a small portable electric welding machine and joined together, and afterwards ground to eliminate any irregularities on the surface. This does not appreciably affect the strength of the rope. The tension is again adjusted on the bobbin and work is continued.

The drawing off is performed by passing the finished strand around a large pulley, the circumference of which is of a specific length. The shaft that carries this pulley is provided with a worm that drives a worm gear and

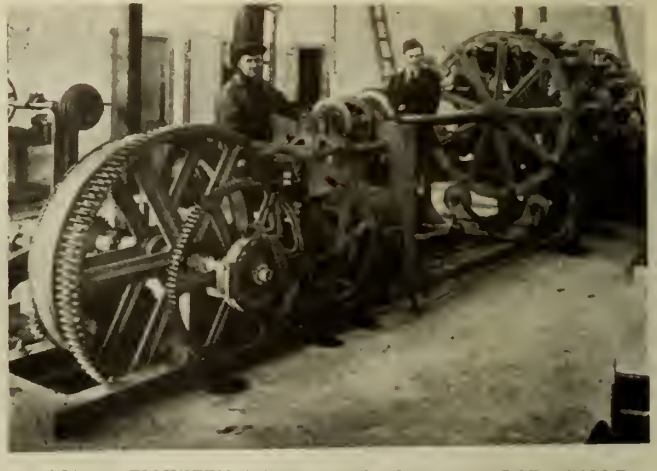


FIG. 4—EIGHTEEN BOBBIN SECTION OF LARGE TRIPLE MACHINE.

vertical shaft, to which, at the upper end, a graduated dial is secured. This dial indicates the number of feet of strand that has been drawn off. After making several turns of the winding wheel the strand is reeled on to the bobbins. These are likewise power driven, geared in unison with the winding equipment. The bobbin shaft,

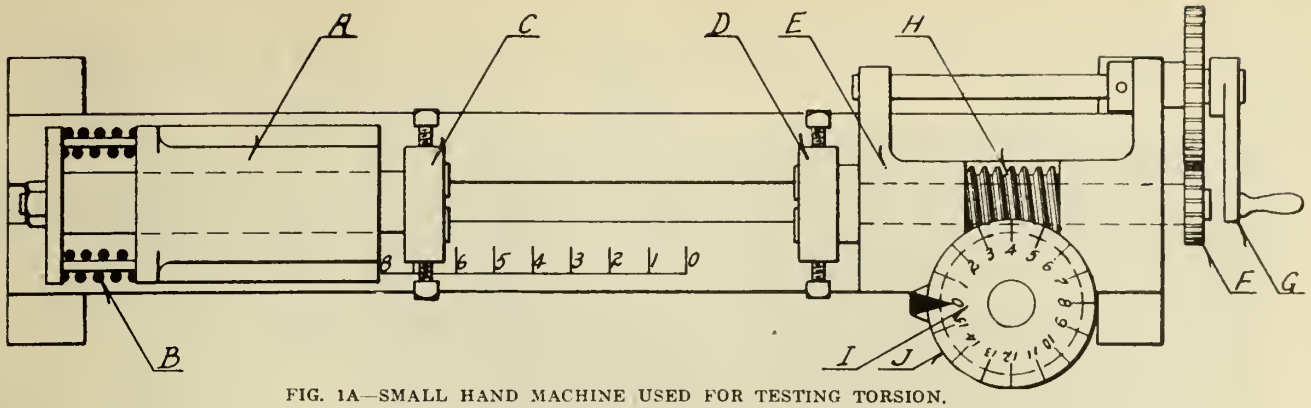


FIG. 1A—SMALL HAND MACHINE USED FOR TESTING TORSION.

however, is driven by means of a friction clutch, to provide for the varying diameters as the wire on the bobbin is increased in volume. Oscillating forks are fitted on the lead side to assure a uniform tracking of the strand. When strands of 19 wires are being made on these machines, the inner section of six wires over one is made on the seven bobbin machine, and this strand is covered by 12 wires in the twelve bobbin machine.

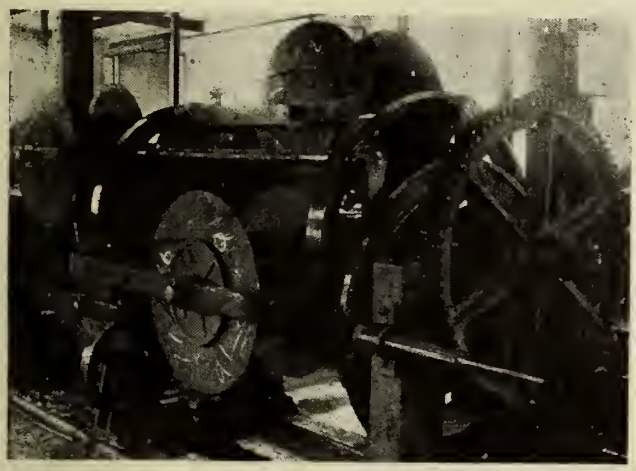


FIG. 5—BOBBIN CONTROL MECHANISM ON CLOSING MACHINE.

Making Combination Strands

A small triple stranding machine is illustrated in Fig. 3. This machine is capable of making strands of every construction for ropes up to 3-4-inch in diameter. The complete strand can be made in these machines at one operation, each head taking care of one gallery of the strand. To roughly show the various details in the making of a strand of 37 wires, the sketch Fig. 3A is given. This is a skeleton diagram of a triple machine, the small head at the lead end taking care of the first section (2) of seven wires (which may, if desired, be used as a strand itself); the second head winds twelve wires about the first seven, giving a strand as shown at (3). The third and last gallery of eighteen wires is wound on by the third or largest head, the result being a strand of 37 wires as shown at (4). It will be noted that the wires here shown are relatively much larger than the machine parts shown, but the purpose of the sketch is to illustrate the general arrangement of the wires as they are located in the different heads, and the process of construction from the single wire to the completed strand.

It should likewise be noted that the centre shaft (which carries the wheels G, for supporting the bobbin cradles and shafts) is not included in the drawing. It should be understood that the central shaft in each head is of the hollow type for the free passage of the largest wire or strand passing through. It may also be stated that one or more heads may be disconnected, or operated in opposite directions, so as to obtain any desired strand construction.

In these triple machines the bobbin that carries the centre or core wire (1) is placed on a reel apart from the machine proper and drawn through the central shaft by means of the drawing off gear. The six bobbins D, for the first gallery (2), are located in the primary head, the bobbins being kept in a vertical position by the action of the eccentric ring A and cranks B, one of these cranks being fitted to the end of each bobbin shaft. This detail will be explained later. The forward bearing of the bobbin cradles is hollow to permit the passage of the wire. After passing through these holes, the wires converge towards the centre and pass through the lay plate F, the combined forward movement of the wires, and the revolving motion of the heads, giving the proper lay de-

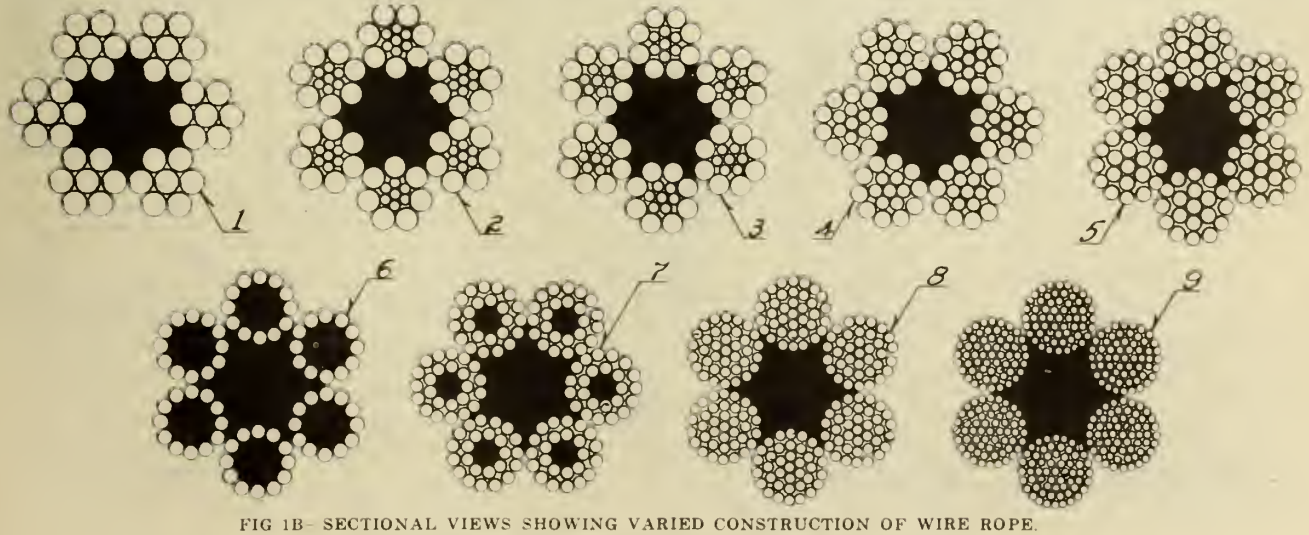


FIG 1B—SECTIONAL VIEWS SHOWING VARIED CONSTRUCTION OF WIRE ROPE.

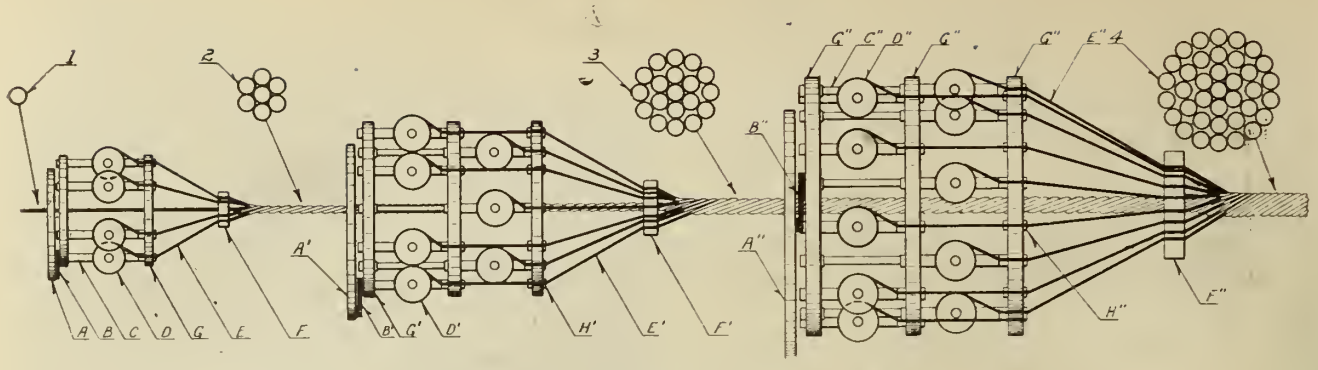


FIG. 3A.—SKELETON DIAGRAM OF TRIPLE MACHINE.

sired for that particular strand. Immediately after the twisting operation, the strand, or that specific section of the strand, is drawn through a die that assists in equalizing the lay of the wires. The different heads, with the exception of the varying size, are quite similar; the larger ones have the bobbins divided into two sections to enable the required number of bobbins to be located in the frame without interference. In this case, the wires from the rear division extend across the forward space and through a bush inserted in the forward containing ring G. The bobbin shafts C on the double heads extend back to the rear ring for connecting up with the eccentric ring A. An eighteen bobbin section of a large triple stranding machine is shown in Fig. 4. This machine has a capacity for making strands of 37 wires of any construction for rope from 1-2-inch to 1 3-4-inches in diameter, in one operation. The machine complete weighs about 21 tons.

Making the Rope

The title cut illustrates the closing machine used for the last operation in the manufacture of wire rope. This particular machine has a capacity for rope up to 1 3-4-ins. in diameter. With the possible exception of cables required for special duty, every wire rope is constructed with a hemp heart, around which the six built up strands are located. This hemp rope is passed through the hollow shaft of the machine in much the same way as the core wire on the triple strander. Before passing to the machine, however, the rope is drawn through a small tank of special lubricating grease which is kept warm by means of an electric heater. The bobbins containing the strands are mounted the same as in the triple stranding machines, and, as a matter of fact, the different machines in a wire rope plant vary only in detail and not in principle.

A detail view of the bobbin control is shown in Fig. 5 and a line sketch of this mechanism is illustrated in the line sketch Fig. 5A. The general design, which is typical of all machines, calls for the use of a separate ring to control the movement of the bobbin shafts. It is essential that premature twist be avoided when closing the rope, and therefore it is imperative that the bobbins be kept in a vertical position while they revolve about the axis of the machine. The central shaft A is supported at either end of the bobbin frame, but owing to the construction it is impossible to provide intermediate bearings; adequate support is provided by running the large wheels B on the rollers C, one of these being located at either side of the machine and secured to the base plate D. The roller brackets are adjustable for centre distance by means of the tie rod E. The bobbins F are carried in cradles G, which in turn are supported in the containing wheels B. The shafts of the forward cradles extend back to the rear for crank connection. These cranks are keyed to the respective shafts so that the cradle bearings for the bobbins are horizontal when the cranks are vertical. The cranks K are all of the same centre distance and when connected to the eccentric control ring H, bring the centre of the latter a like distance below the axis of the machine. This ring H is free to revolve about its own centre and is kept in vertical alignment by means of the two guide rollers I, which are located on studs passing through a cross bar J of the machine frame. It is quite obvious that, no matter in what position the machine may be, the cranks, and likewise the bobbins, will always be vertical.

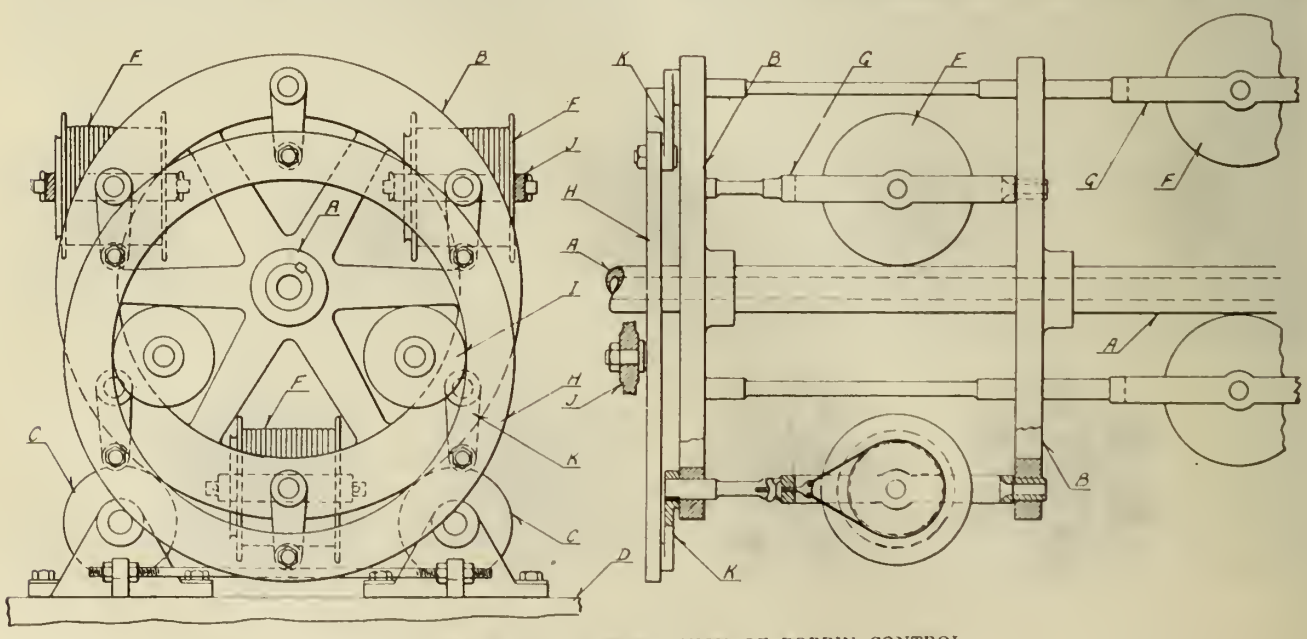


FIG. 5A—DETAILS OF MECHANISM OF BOBBIN CONTROL.

Treat *Machines* Better than the *Men*?

Well, Perhaps They Didn't Mean It To Work Out That Way, But the Foundry of To-day Filled With Molding Machines is Brighter Than the Old One Filled With Men

By F. H. BELL
Editor "Canadian Foundryman"



A TYPICAL MODERN FOUNDRY BUILDING. ABUNDANCE OF LIGHT, HEAT AND VENTILATION.

COULD there be anything more interesting or fascinating than the moulding and founding of metal? To see the agile artisan plying his tiny tools and his dexterous fingers in the skilful preparation of the moulds, and to see this same artisan and his nimble fingers converted as though by magic into a giant of herculean strength with brawny arms conveying the ponderous ladles of molten metal, boiling and seething from the melting furnace, to be poured into the moulds which he had just completed a few short moments before? To see the honest sweat streaming from his brow as he tears the moulds asunder, and exposes to view the red hot castings, true to every detail, and to note his beaming countenance as he gazes with well-deserved pride upon his handiwork?

Truly, it is a magnificent sight.

Yes, the programme of the moulder is wonderful, but for those of us who have spent our days within the gloomy precincts of the moulding shop as a means of keeping soul and body together, much of the grandeur and magnificence has been overlooked, or perhaps the fascination and the interesting features in connection with the moulders' noble art did not present themselves to us with the same degree of prominence as did some of the other more notable characteristics of this most necessary institution—the foundation of all mechanical achievements—the foundry.

The Surroundings Were Dingy

But they were there just the same, hidden away behind a sand heap or buried beneath a pile of debris, and while our eyes were bleared with core smoke and our brains befogged with foul gas and dust, we allowed the fascination of the surroundings to go unnoticed.

It is all right for the uninitiated foundryman who has received his foundry experience at the office desk to say that we take the wrong attitude, which perhaps we do, but under conditions as they existed there was no other attitude which a person could take.

But with all its shortcomings, the foundry, with its various features, is one of the most interesting of callings and one which bids fair to hold a more prominent place in the manufacturing world than it has done since the days of Tubal Cain.

Improvements Have Come

If the moulder, who perforce sees nothing but the dismal features, cannot become interested enough to suggest improvements, it behooves the employer to do so, but up to a comparatively recent date moulders have been so plentiful and apprentices so eager that no thought of change was ever considered, and if Tubal Cain could have come back to earth forty years ago and could have visited the average foundry he would have identified most of the equipment as his invention and would no doubt have been able to point out improvements which he had devised and which had since been forgotten.

With modern improvements in other lines of occupation and with increased educational advantages, the youth of the last few decades has not taken kindly to foundry work, with the result that moulders were becoming extinct and the trade a lost art. With the shortage of workmen came the idea of replacing them with machines, but little attempt was made to improve the conditions so that machine operatives could be retained and as a result common laborers drew the line at machine operating amid such surroundings as were met with in the foundry. This resulted in the employment of foreigners who, so far, have done most of the machine moulding in this country.

Must House the Machine

But now comes the difficulty which touches the tender spots. It has been discovered that the foundry is no place in which to install a machine, or in other words, it does not pay to keep a foundry in such a condition if machines are to be used. It has been found that no matter what precautions have been taken by the manufacturers of foundry equipment, the dust and dirt of the foundry is too much for a machine to endure, notwithstanding the fact

that human beings were expected to endure it through all the hundreds of years since foundry work began.

As a result of this latest discovery, an organization has been started which embraces practically all the manufacturers of foundry equipment and is known as the Foundry Equipment Manufacturers' Association. They have begun a determined campaign to induce foundrymen to make their foundries fit places for the equipment, and this campaign is already having its effect and to-day no foundryman would think of building a foundry without engaging an industrial engineer to design and superintend its construction. The result of this move has been most satisfactory and now we may look forward to a new era in foundry work. Like war, which with all its horrors, brings out inventions which would probably never have been thought of in the ordinary course of events, so the foundryman, with his careless indifference, has been the means of bringing out improvements which would not have been considered necessary had it been possible to continue in the old way.

Some Practices Contrasted

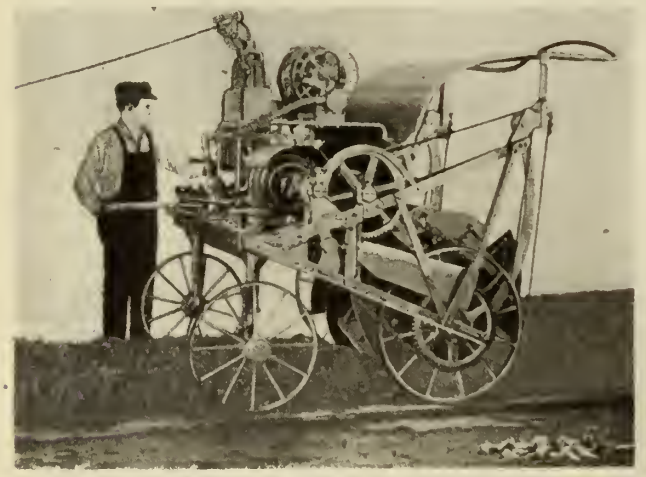
As a comparison between the methods of my boyhood and those of to-day, I will give a few examples which should convince the reader that the foundry is no longer lagging behind. In those days the apprentice was put through the entire foundry process, which included attending to cupola. This part did not appeal to him, but it was the proper thing to do and should still be the rule. He cleaned castings, helped cut over all the sand heaps in the shop, made cores, etc.

To begin with, the castings had to be removed from the sand by hand. To-day they are placed upon the table, suspended from the trolley car.

Then the water was thrown on from a pail—now it is put on with the sprinkling system.

After being wet down two men took opposite sides and with shovels smashed the lumps and cut the sand up in a heap. Now the sand-cutting machine straddles over the floor and in moving the length of the room leaves a finished sand heap in its wake.

In the core room the sand was prepared by getting a barrow load of sharp sand, a pail full of moulding sand and a measure full of flour. These were all pitched back and forward until considered mixed, after which the mass was run through a No. 8 sieve. It was then spread out



THE MODERN METHOD OF CUTTING UP THE SAND HEAP.

and punched full of holes with the shovel, and wet down in a similar manner to the sand heap and cut over several times to be sure it was mixed, when it would this time be run through a No. 4 riddle. Now the sand is mixed and tempered in a power-driven sand mixer.

Formerly the cores for every purpose were made in halves so that there would be a flat surface against the core plate. The halves would be dried and afterwards pasted together and dried again and black washed. Now, cores are jolted into the core boxes, or blown in by compressed air, and for straight round cores or even cores which are not round, a machine similar in many respects to a sausage stuffer is used and the core made perfectly



THE REGULAR WAY OF POURING COMPARED WITH THE METHOD WHICH IS COMING INTO VOGUE.

true, of any length required and with the vent hole the entire length.

More Laborious Work

In charging the cupola the only means of getting the coke and iron on to the platform was to carry it up the stairs and dump it on the floor, after which it was rehandled and put in the cupola. The cleaning away from under the cupola was equally as interesting. The coke, iron, cinders and sand had to be separated by hand, by picking out the coke and putting it in a basket. Bits of iron were put in a tote box and the cinders which did not appear to carry much iron were wheeled to the dump. The balance was put in the cinder mill along with the siftings from the sand, and from the gang-way a few chunks of pig iron put in with them, and the whole outfit tumbled until nothing was left but the iron. The cinder mill was, of course, well supplied with openings to allow the ground cinders to escape and that which was not heavy enough to fall to the floor did the next best and went all over the shop in the form of dust.

But It Is Different Now

To-day there is no part of the plant better taken care of than the cupola. Wet cinder mills grind up the cinders and separate the coke and iron and are dustless. Sand sifters of various types are provided for sifting the sand which will form the bottom, while magnetic separators recover the last speck of iron from the gangway and hoists to suit every condition are used to deliver the material to the charging floor.

The scratch room of to-day instead of being the dust-laden department of former days is as free from dust as any part of the plant. Instead of putting the castings in the old-fashioned tumbling mills, similar to the one back of the cupola, the tumbling is done in tight mills which are connected to exhaust fans which carry all the dust outside of the building. The grinding wheels are likewise connected to the same system. In addition to these there are new devices which were not known many years ago and which are not only labor-savers, but are reasonably dust-proof. Instead of the hand scratch brush and the

chisel and hammer, the modern foundry is equipped with revolving scratch brushes which are either operated on a machine similar to the grinding machine or carried about on a flexible shaft or on a portable grinding apparatus. Pneumatic chisels and sand blast apparatus of innumerable types do the work cheaper, better and healthier than formerly was the case.

The Modern Way of Pouring

But the part which is of vital interest to the employer and employee alike is the progress which has been made in methods of making and pouring the moulds. Up to a very recent date this was done entirely by hand and the moulder had to keep up a continuous motion every minute in the day or else he did not do a full day's work. To-day machinery does the bulk of it and the moulder's part is not the slavish job it used to be. As we have shown, the sand heap is prepared by machinery and no matter what class of mould is to be made there is a machine which can be used to advantage on it. In pit work the grab bucket cleans the pit out and the automatic sand sifter riddles the sand; the sand mixer prepares the facing sand; the pneumatic rammer does the ramming and the power crane does the lifting. In doing floor work the jolter does the ramming and if the work is such as will warrant the outlay, the jolting machine is built to turn the mould over. If the work is large the electric crane is used for lifting, but for medium work the pneumatic hoist is used to exceptionally good advantage and in many places the differential pulley block such as is built now can be used where no other device is as satisfactory. For small work such as has been considered as bench moulding, the squeezer has been perfected to such an extent that it will do most any job which was formerly done on the bench, and for work of a more difficult class the jolter, squeezer, stripper and pattern drawer offer a sufficient variety from which to choose the required combination to do practically any job.

Oven for the Job Shop

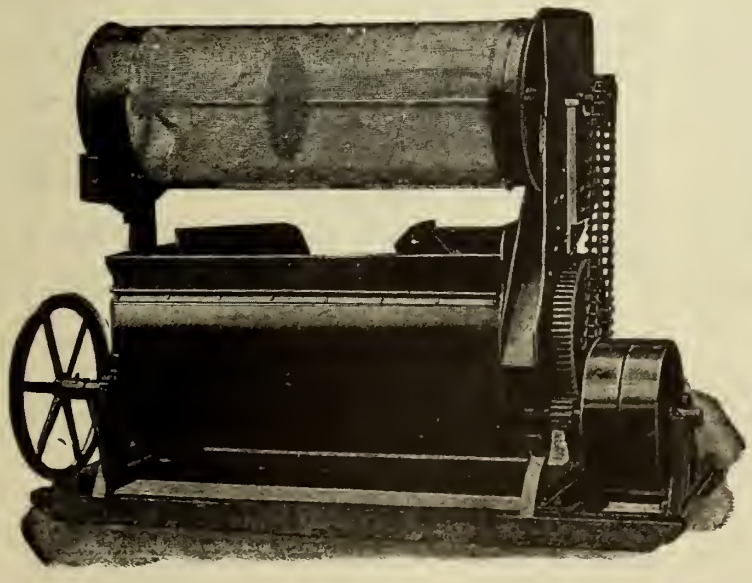
For jobbing work where the pattern-drawing device cannot be used to advantage the air hoist has many advantages. The air hoist is also used advantageously for lifting copes, handling cores, etc. For heavy lifting, cranes have been used for many years, but they were hand-operated. To-day almost any foundry will have electric cranes traveling the entire length of the shop and in addition have numerous small pneumatic cranes which can be lifted from place to place by the electric crane and connected to the compressed air pipe by means of a hose. In addition to this a modern foundry is equipped with trolley track connecting the cupola spout with the different floors, so that the moulder has no carrying of metal excepting on his floor and this is being dispensed with now to a considerable extent by the use of pouring systems which connect up with the main track. These pouring devices are so perfected that the ladle can be raised to any height and the mould poured to as good advantage as could be done by hand and with greater ease.

All told, the foundry of to-day is on a par with any other business, with the possible exception of the atmospheric conditions and these as we have already pointed out are being rapidly brought into line in order that the equipment will give the maximum of efficiency and the men who had been overlooked are automatically absorbing the benefits which were primarily intended for the machines.

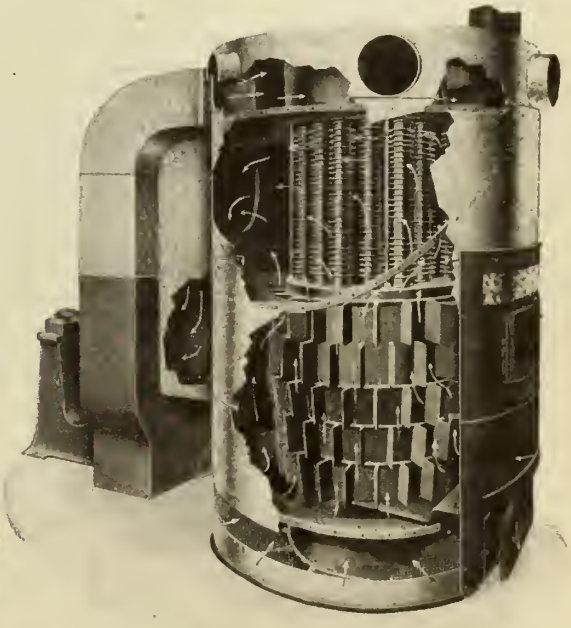
By employing competent industrial engineers who have had actual experience in the foundry to superintend the construction as well as the heating and ventilating of the new foundries, it has been found quite possible to have good, clean air which does not stick to the oil on the machinery and which does not stick in the lungs and nostrils of the workmen.



CUTS CORES TO EXACT LENGTH AND TAPERS THE END.



SIFTS THE FACING OR CORE SAND AND MIXES IT IN ONE OPERATION



HEATS AND VENTILATES THE FOUNDRY AT THE SAME TIME.

Every Man Cannot be an Executive

Some men prefer their regular shop work to any style of office position. This tale, while fanciful, illustrates that dissatisfaction is, after all, largely imaginary.



"WHEN are you coming home, Jack?" My wife was phoning me at the office, and in my tired condition, her voice sounded as if it were a thousand miles away.

"I'm sorry," I replied, " but I will be at least a few hours yet. I have some important appointments, and it may be ten or eleven o'clock before I get through. Eat your supper alone. I'll be home as soon as possible."

"I'll bet you're tired," came back my wife's voice. "You win," I replied, wearily, hanging up the phone.

Reviewing the situation, I could not help feeling both disappointed and disgusted. Here was I, working till all hours of the night in an endeavor to pacify, and perhaps satisfy, a plant filled to the door, so to speak, with disgruntled workers. Truly the position of manager in a manufacturing plant was no sinecure, much as some would have you believe it so.

For the past few months things had gone far from smoothly. Threats of strikes had been numerous, and the cry had always been the same. "MORE MONEY, THAT IS WHAT WE WANT." Never had there been a word about production. In fact, had I stated that production had gone down instead of up, the workers would have keenly resented my critical attitude, and perhaps have struck, just to show they were of an independent nature.

And yet, had I not the right to speak on that very point? viz., that if wages go up, production should soar accordingly. Suppose, I pointed out, that profits were lower—but there again was a nasty snag.

Profits—why the workers hated the very word. They felt that the firm was making millions, when truth to tell we were just working on a safe margin. True, I was making a comfortable salary, but why shouldn't I? Was I not working for it just the same as the men in the shop? To the men in the factory, I was the fellow who held down the soft snap, who wore a clean collar and a silk shirt every day, and rolled down in my limousine around 11 a.m.

The truth of the matter is, I never wear a silk shirt, and can afford nothing larger than a Ford. I am at the office every morning not later than 8.30 a.m., but you know the old saying, "Give a dog a bad name."

In thinking these things over, I must have dozed off, for suddenly I awoke to find a tall dignified stranger confronting me.

"Pardon me," I said, "but I don't seem to know you."

"You do—and you don't," said the unexepected visitor." "You used to know me, but lately you've neglected me terribly."

His manner of speech puzzled me and I must have looked it, for he continued, "If agreeable to you, I want to help you out of your present quandary. Don't bother explaining, for I know all about your trouble. You wonder who I am, and how I know of it? Well,—my name is Courage. all men need me but seldom use me. Lately, they have been using my brother, who is known as Let-well-enough-alone. Candidly, if you don't mind my saying so, that is your trouble so far."

I was taken aback and must have looked it. Finally I stammered, "Well, what to your mind is the solution to the present trouble?" My visitor seemingly paid no attention to my last remark for he replied, "Why did you stay at the office to-night?—don't bother answering, for I know already. You have made engagements with various men in your plant who are dissatisfied. You have also arranged for them to come at different times, a rather clever idea in its way,—but why are you meeting them in this secret manner? I'll tell you."

The method of my visitor's asking, and answering his own questions was rather disconcerting, but wait, he was continuing: "You expect, by meeting your men one by one to pacify them, thus avoiding the latest of the threatened strikes. Am I right?"

I had to admit he was, but ventured to ask how he guessed.

"I never guess, I know," came back the dignified reply. "Look here, Jack (why, he even knew my first name), you've got to do something definite, or a strike is assured. Why not take me as a side partner? I want no wages or profits, and my cousin Good Judgment will come at the same figure as myself, namely, consideration. Between the three of us we can see this matter through. What do you say?" I nodded my head, and the moment I did so, in walked Good Judgment.

He recognized me as an old friend and the three of us bent our heads closely together, discussing the situation to our hearts' content. We laid a plan, that had better not be

told for the present. Enough to say that it was none too soon, for there was a sudden knock on the door, telling me that the first of my expected visitors had arrived.

"I don't want these men to see you," I said to my two companions.

"They won't," replied Courage laughingly. To them we are invisible. To you, we are ever present, but remember this, we are of no use to you except you use us. You must ask us to help. Good Judgment will help you out of many a hole, and personally I'll give you the courage to see it through, but remember, you, and you alone, can command us.

With these warnings ringing in my ear, I shouted "Come in," and the door opened to admit Waeburn, the head of my automatic department.

The Plan Works

Waeburn seemed ill at ease. "What is it you want?" he commenced. I felt Courage right beside me so started in with my heavy artillery.

"Look here," I replied, "you asked me to-day for an increase of $600 per year, and threatened to call your men out, if you didn't get what you asked. Why?"

This certainly was not the sort of conversation I had intended having at the start, but Good Judgment whispered in my ear that it was for the best, so I kept on that track.

"Well," replied Waeburn, "I want more money because I've recently got married and I find the going rather rough."

"Is that the only reason I should give you $600 more every year?" I asked.

"No," came back Waeburn, "but I've done my work for the past five years as best I know how."

"That is your opinion," I shot back.



My workers imagined that I wore a silk shirt, and rolled down in my limousine about 11 o'clock every morning. Instead of that I often work from 8.30 a.m. until 11 p.m.

This rapid fire reply staggered Waeburn, for he spluttered out that he didn't see why I should suggest he was not doing his duty.

"Look here," I continued, "let us talk this thing out in a candid manner. You listen to me first, hear my viewpoint, then see if you can still honestly ask for the extra $600. First of all, I admit you've worked for us for five years, two as foreman. In that time you have had a good chance to study your men, the machines, the operations performed on them and so on. In other words you should know your department pretty thoroughly by now."

"I do," he replied.

"Very well," I countered, "we will see if you do. Take operation XXX on that small spindle you are doing out in the shop at the present time; do you think we are doing that work in the best way possible?"

Waeburn looked amazed at me. "Why, we've done that job the same way for the past five years," he said.

"Sure," I replied, "that's the trouble. How do we know that's the best way. Have you ever tried any other method?"

The look on his face was answer enough, so I followed up my advantage. "Do you know that I had a young fellow up from your department to-day who suggested what looks like a better plan of doing that work? Of course I told him such a suggestion should come through you, but his reply was that he had tried to get your ear before, but his reception was far from pleasant."

"You mean young Smith, don't you?" sneered Waeburn.

"Exactly," I replied.

"Oh! he makes me sick, always some new idea. If he had his way we would reorganize the whole plant."

"Well, he's going to get his chance," I replied. "I'm placing him in charge of your department and starting to-morrow morning."

This statement was wholly unpremeditated on my part. I had never even thought of it before, but Good Judgment seemed to suggest it and Courage carried it through for me. Waeburn's face was a study.

"Where do I get off at?" he asked.

"You come into my position," I replied. You could have knocked him down with a feather. "Remember telling me yesterday I had a cinch of a job?" I asked. "You said you wished you could get such a position. You would show us what you would do. Well, you've got your chance now. I've been working too hard lately and I'm going to take a well earned rest."

"But look here," said Waeburn, hastily, "I was only fooling. I couldn't run your job. I don't know the first thing about financial matters and I don't know ———oh, what's the use, Mr. Blank, my place is in the shop."

"That's where you are mistaken," I replied, "but we will consider my first suggestion. In place of giving you full charge you'll work under my supervision. To start with, you get no more money than you are making at the present time, but if you make good, leave the salary matter to me and it will be very much in advance of the $600 you are asking for."

I looked at my watch, saw that my next visitor was about due, so decided to close the interview.

"Well, then, that's settled. Report to me at 8.30 in the morning," and I showed Waeburn out in a much more dazed condition than when he came in. In spite of the novelty of the move, I felt it was a good one, in fact Good Judgment told me it was and as for Courage, I felt quite proud of him.

The Second Visitor

Suddenly, in walked Grogan, my foundry foreman. It was like Grogan to walk in unannounced. He never knocked at my office door, and though I had often felt like telling him about it, I never had Courage with me before.

"Look here, Grogan," I said, Courage backing me up, "Before you come into my office knock at the door first, then wait to see if it is convenient for you to come in."

Grogan's face was a study. Never had he heard me speak like that. Somewhat abashed, he said: "Why, I never knocked before."

"All the more reason you should start now," I replied. With this remark, I considered that I had said enough and started on a new tack.

"You were raising Cain with me the other day," I commenced, "regarding the poor supplies you were getting for the foundry."

"You said something," he growled. "Why the purchasing department you have is a joke. There isn't a practical man in the lot. I could buy better than that bunch with my eyes shut."

"Do you think so?" I ventured.

"I'm sure of it," he replied.

"Very well, then, consider yourself purchasing agent starting to-morrow morning," I said, and Grogan's expression was something beyond description.

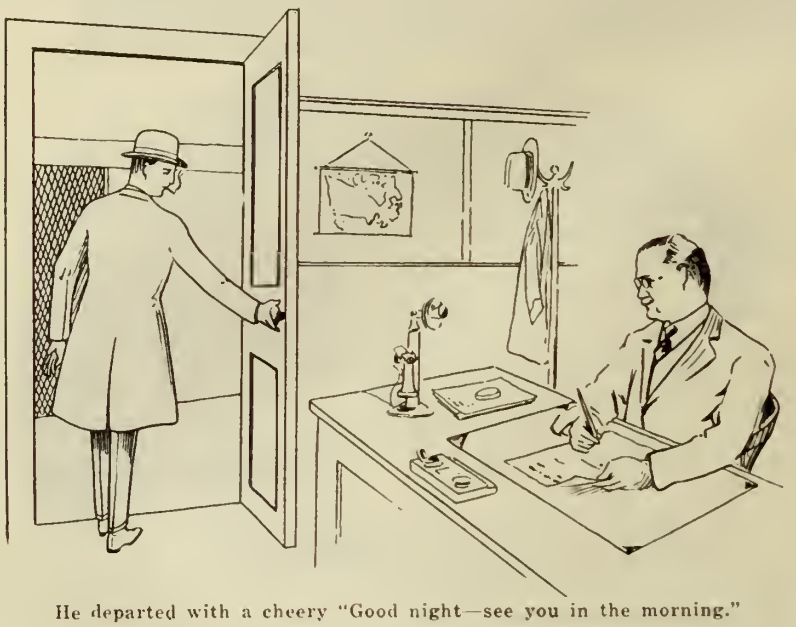
"Do you mean that?" he asked.

"Certainly," I answered.

"What about the foundry?" "Bell, your assistant, will run that," I replied. "Now look here. You've said a great deal about the need of a practical man in charge of the purchasing department. You've been with the firm since it started. As far as I know you started in the shipping department, did you not?"

A nod of the head was his only answer.

"Since then you have been through every department. From previous experience you should make an ideal man for the purchasing end of this business, so be prepared to dig in at 8.30 to-morrow morning. If you make good you get even more of an advance than you asked me for last week." With this remark I ushered him out in much the same condition as Waeburn, my previous visitor.



He departed with a cheery "Good night—see you in the morning."

An Easy One

The next visitor was easy to deal with. He was a new recruit in the drafting department, named Jones, who could see no reason why he should not be chief. As for the salary he was making,—well it was disgraceful, to use his own expression. In a previous talk with his chief I had decided to discharge this youngster, but on the chief's recommendation, I had agreed to let the matter slide. "There is good material there if we can develop it," said the chief. Personally I felt he would never discover it, as this fellow was one of the never satisfied type, but my rule is, give every man a chance to make good, so on he stayed.

The talk with him was brief and to the point. "You want to be chief, don't you?" I said.,

"Yes," replied Jones.

"Very well, you are," I replied.

This remark took the wind out of his sails.

"You mean the present chief is discharged?"

"No, promoted," I answered. He is now chief engineer, but you are chief draftsman.

"What salary do I get out of this?" he asked. In a way I admired his nerve, but replied that his salary would remain as it was until he proved himself.

"In that case, I won't take the job."

This was a new one on me, and I had to call on Good Judgment for advice. "Take him up on it," was the advice given me, and I did.

"All right, how much do you want?" I said. With a smile at thus winning his point, the young upstart, if I can call him that, stated a figure equal to the salary of the regular chief. "You see," he explained, "I know what he gets."

I merely nodded, signified my acquiescence and told him to start in the morning. Somewhat cocky at my ready acceptance, he strutted out of the office with a "Good night, see you in the morning."

Courage smiled as he departed. "It took all my patience to go through with that," he said. "Instead of tolerating him, I felt like throwing him out." "Still," interrupted Good Judgment, "I believe it's best for the department. There are quite a few in that department who think they ought to be chief, and this will be a lesson to them." My next task was one of diplomacy. I called up the suddenly deposed chief, explained my scheme told him to let matters go only so far to the bad and wished him a cheery good-night. When all was said and done, I felt better than I had earlier in the evening.

This being my last visitor I closed the desk, and turning to my two friends, said:

"Where will I see you in the morning?" The reply was what I expected.

"We're going home with you," they replied, "and what's more, we're going to stick with you until the end, always providing of course, that you want us."

"I never needed two such friends as much as I need them now," I answered earnestly, and with that we all departed.

The Morning After

The morning following these sudden changes was a hummer. The men in the shop, who were thus suddenly promoted to be foremen of their various departments, had nothing on the three who were raised to positions of assistant manager, purchasing agent and chief draftsman respectively. I was on the job as usual to tell the new seekers after fame what they were expected to do. Rumors floated from department to department, and the one most generally conceded to be correct, was that I had suddenly gone crazy. Some of these wild guesses came to my ears, but I merely smiled, sat tight, kept right alongside of Courage and Good Judgment who told me to see all and say nothing.

The climax came when the following notice was placed on the bulletin board of every department throughout the plant: "Three men have lately been promoted to executive positions. This has been done with a definite purpose, viz., to help these men advance. If capable, they will be retained in their present capacity. The firm wish their men to be satisfied, and, if after three months, others desire an executive position, let them make their application to me personally."

If rumor was rife before, it was greater after the posting of this notice. The men could not understand it. Their dissatisfaction, which after all was only imaginary,

turned to wonderment. What on earth was the G. M. trying to put over them? Wonder changed to worry. Were the newly appointed executives capable of running the plant, and so it went on, until like all nine day wonders, interest waned and the shop went on very much as before.

Three Months Later

It was three months later that I had an uninvited visitor at my home. It was Waeburn, and a very changed Waeburn at that. After some humming and hawing, he blurted out the object of his visit.

"I'm a failure," he commenced, and then, out poured a tale of woe, that was already known to me through another source.

"I guess I'm not such a world-beater after all," continued Waeburn. "As an automatic department foreman I'm passable, but as assistant manager, well—I've made a mess of things, but thanks be I'm man enough to admit it. I've changed my mind a great deal since our last interview. Managing a firm is not all sunshine. I've tried hard. I've spent hours every night attempting to handle the job successfully, but I give up, it's no use, so, if agreeable to you, I'll leave a week from to-day."

"What seems to be your chief trouble," I asked.

"Frankly," replied Waeburn, "I realize now that one requires more than bluff to be come a manager. I fell down on the job simply because I lacked training, and in falling down, I also see why I was not satisfying you in my last position. As assistant manager I was entirely out of my field. Instead of liking the job, as I imagined I would, I much prefer work along my own line, namely, automatic machinery. I see plainly where I did not make the most of my opportunities in the shop. My policy was Leave-well-enough-alone, but I assure you, the lesson taught me has fallen on good soil. I tell you all this, to show that your giving me a chance to make good is appreciated. Having thought the matter over I decided to hand in my resignation."

"Where do you expect to go from me," I asked.

"I don't know," he replied.

"Would you consider taking over your old department?" At my question Waeburn stiffened. "Would that be fair to Smith, the present foreman?" he asked. I laughed. "Smith was in to me about an hour ago," I said, "and told me the job was too much for him. He is rather young yet and lacks experience, but Waeburn, you and he would make a great combination. What do you say? Will you accept?" It did not take him long to see my viewpoint, with the result that a notice was posted in the shop announcing his return the following week. On returning to the shop, he was honest enough to tell his men frankly why he had returned and that he had not made a success of the new position.

News of this character travels fast, and it was just a few days after Waeburn's return that I received a note from Jones, the recently appointed chief draftsman. His letter was written from his home explaining why he had not appeared at work the previous day. The note commenced in this strain:—

"When I took over the position of chief I was a hair-brained ass. Of course I didn't see it that way at the time, in fact I felt rather proud of myself, that at last I had convinced you of my worth. I felt it was a shame the way the firm had held me back. I was thoroughly convinced that my chief had a soft snap and that my knowledge was greater than his.

"Since taking over the position things have gone far from well. I pity my late chief when he once more takes over my position. I say this because, as far as I am concerned, I'm through. Unlike Waeburn, I'm not man enough to come and tell you personally, and I cannot go back to my old job again. By the time this letter reaches you I'll be on my way home. My folks often wanted me to go to college, but I like the crowd of goodfellows better. However, I've learned my lesson. I see that Education is the thing, and I'm going to get it. I intend taking a short College course for a year or two in the hope that by that time I will really be capable of holding a position such as you gave me an opportunity at. Where I fell down on the job was lack of experience. My theory was only half matured and my practical knowledge was nil. Incidentally, I intend to work in the summer months for some machine shop to build up on the practical end of the business. As I said before I've learned my lesson. From now on personal effort is what I will rely on."

I could not help but remember the chief's words as I read this letter. Truly the good in this fellow had come to the surface.

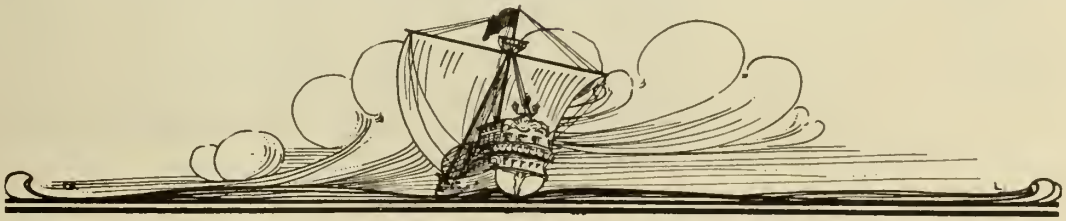
As for Grogan his story is different. He had luckily made the most of his time, and knew the requirements of the plant like a book. He not only held his position but made a wonderful success of it, saving the firm thousands of dollars through his insight and experience. A notice was posted on the bulletin board to the effect that Grogan was to be retained in his present capacity, and the reasons for his success were given. "Grogan has made good," read the notice, "because he has made the most of his time in the shop. He has saved the firm considerable money since his appointment. This he has done because he knows our requirements. For some time past we have heard rumors of unfair treatment to our employes. Any such employe who has a reasonable complaint can see the manager any evening at his home, and will be given a chance to prove himself. Above all the firm wish their men to be satisfied."

After the posting of this notice I waited breathlessly, yea, almost anxiously, for the result. Would a stream of dissatisfied workers call at my home, or would only a few take advantage of this opportunity to unload their troubles? I needed Good Judgment and Courage very much, but they both assured me the posting of the notice was a wise move.

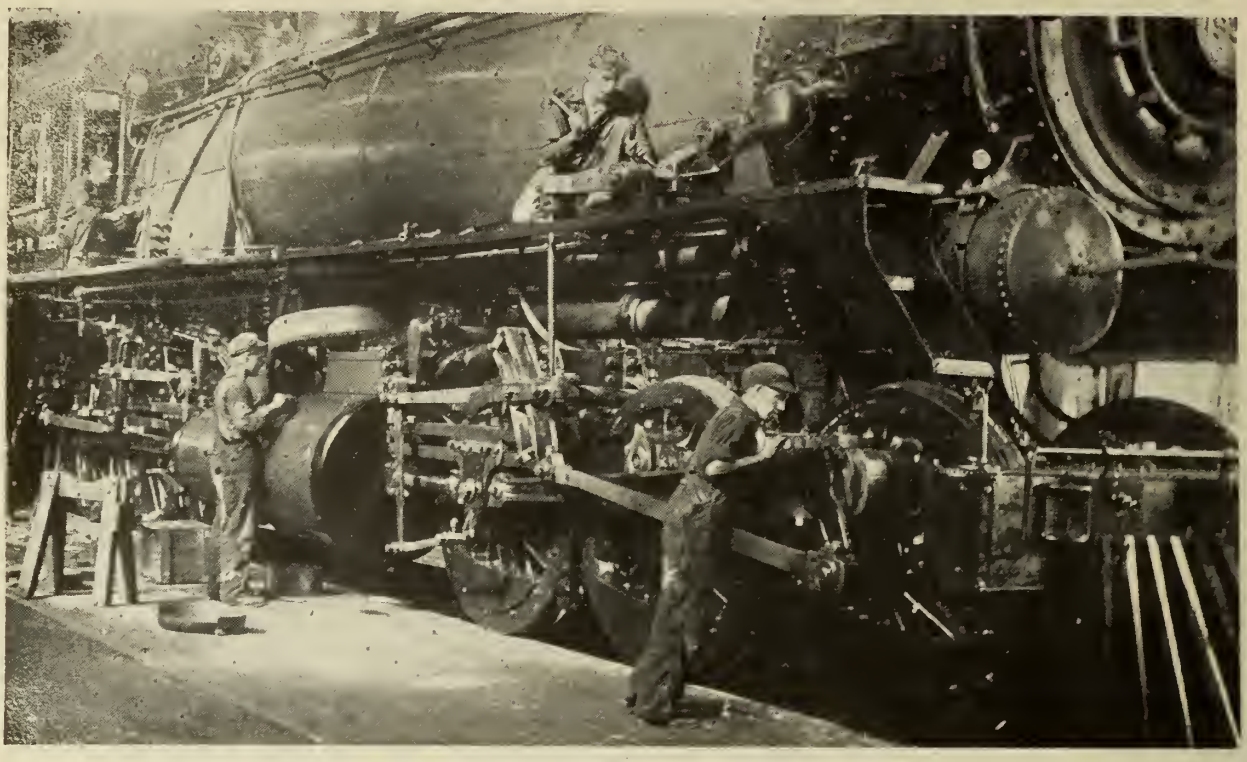
So far, no one has called. Evidently my workers are more satisfied than formerly. Six months have passed since the posting of the notice, and production has soared wonderfully in that time. The results coming from the automatic department are especially good. As I expected, Waeburn and Smith make a great combination, and what's more, they work together. I take no unfair advantage of any man in the plant. Every one who makes a suggestion is thanked for it, and if adopted is rewarded accordingly. Courage and Good Judgment still stick with me, in fact I told them the other night they must never leave me, and they laughingly told me, that depended entirely upon myself. A rather fine answer when you think it over.

* * *

Has the above story impressed you? True, it is imaginary, but after all what is labor unrest? Is it not also imaginary trouble. Men are always aiming at the position they think they would like, not to make better the job they have. Let us get more of the spirit to make good on the job we've got, and the higher position will come; when we ourselves are ready for it.



Systematic Control of Locomotive Repairs



THE FINISHING TOUCHES TO THE ENGINE, JUST PREVIOUS TO ITS LEAVING THE SHOP.

By J. H. Rodgers

THE wide and varied detail work that is required in the repairing of locomotives would seem to present, particularly to the layman, an engineering problem where considerable difficulty might be experienced in obtaining a satisfactory solution by adopting any systematic method of pre-arranged classification of repairs on each and every locomotive as it is taken into the shop.

Three score years and ten are set down as the allotted age of man, but his own weaknesses, and the uncertainties of life, provide many opportunities for relentless fate to place him under the care of a physician or in the hospital, for varied periods, to undergo light or heavy repair, or general rebuilding. Locomotives are not unlike human beings in this respect. The periodical "life" of a locomotive is estimated on a mileage basis, this depreciating as life is extended, and while many engines may, and frequently do, cover the scheduled distance before being shopped a great number must necessarily be taken out of service at irregular intervals and placed in the shops to undergo "hospital" treatment, in order to fit them for the service they are called upon to perform.

Engines may be taken off the road for one, or more, of a multitude of causes, and it is this varied combination of "infirmities" that has, until recently, made it so perplexing to draw up effective repair schedules. The principles of production control have been universally practised for many years by large manufacturing industries, but apart from localized effort in some particular department no general organized movement has been made by railway companies to prove its adaptability to general repair activities.

In the case of new equipment units, where the work, from the rail up, is that of straight manufacture, the problem

PROGRESS SHEET - WEEK ENDING DEC. 4th. 1920.

Div.	Eng.	M	T	FB	In Shop	Out Shop		
A	3927	4	1-1		11-1	29		
NB	2663	4	1-1		11-5	29		
A	3825	4	1-1		11-17	29		
0	2551	4	1-1		11-9	30		
Q	3356	5A				30		
0	750	3	1-1	4	10-4	30		
A	3864	4	1-1		11-2	12-1		
0	1099	3	1-1	1	10-25	1		

FIG. 4—A PORTION OF A PROGRESS SHEET.

ANGUS SHOP REPAIR ENGINE OUTPUT.

DATE	DAY	Gang 1 Clarke	Gang 2 Larocque	Gang 3 Prioe	Gang 4 Coates	Gang 5 Sly	Gang 6 Baker	Gang 7 Hogan	Gang 8 McWaters
	Mon.								
	Tues.								
	Wed.								
	Thurs.								
	Fri.								
	Sat.								
	Mon.								
	Tues.								
	Wed.								
	Thurs.								

FIG.1—THIS FORM IS USED FOR REPAIR ENGINE OUTPUT.

DATE.....

FOREMAN.....

Please note that the work on Engine.....

has been stopped on account of.....

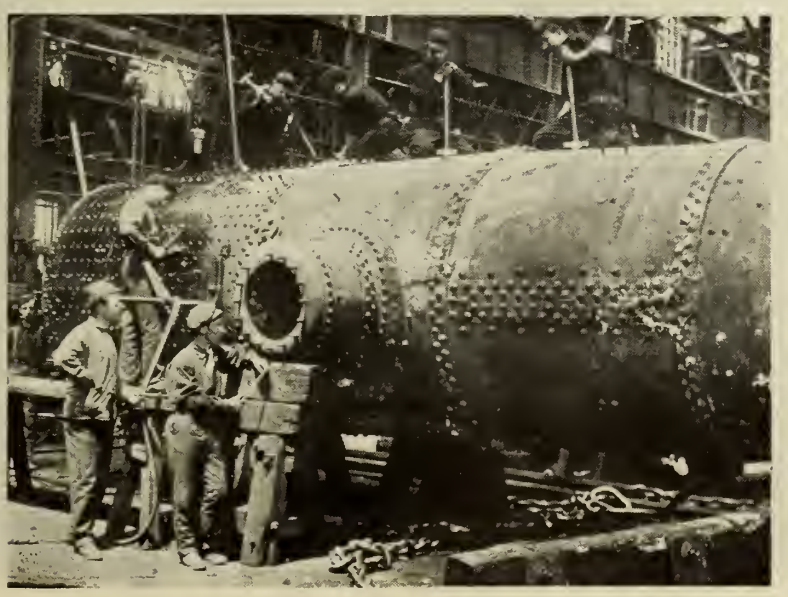
Engine will be re-scheduled later.

FIG. 2—THIS FORM IS USED WHEN AN ENGINE HAS BEEN SET BACK.

does not present any serious obstacles, but on repair work—and this constitutes the bulk of any railroad shop activity—the inauguration and subsequent successful operation of an efficient production control system, is, apparently, encompassed with such complicacy that considerable courage and executive ability are fundamentally essentiol, on the part of those in charge, before the work can be carried on with any degree of permanen success.

The Canadian Pacific Railway is probably the pioneer railroad company to recognize the economic possibilities from a well-organized production department, not alone in the construction of new locomotives, freight and passenger cars, but also in the general repair and maintenance of all motive power and rolling stock passing through the shop. When the system was initiated at Angus shops, nearly three years ago, it was not started on an experimental basis. The executive heads, believing that systematic methods from a production standpoint could be successfully applied to railroad repair work as well as other lines of industry, placed the control of the organization work in the hands of capable and experienced officials, to "establish the department on a firm foundation so that future building would improve, and not detract from, the strength of the structure.

The estimated repairs to any locomotive is based on the road report and the initial inspection made by the shops inspector and the general shop foreman. It might be stated that road requirements, to a large extent, determine the particular engines that are to be taken into the shops from time to time. Under normal conditions engines would take their turn on a mileage basis in being shopped, but urgent demands are often made for extra



A VIEW SHOWING A PORTION OF A BOILER UNDERGOING REPAIRS.

output of a certain class of passenger or freight engine which must be met irrespective of any regular order.

After the preliminary examination the engine repairs are classified as 4A, 3B, 1C, etc. At Angus these classifications are indicated as follows: No. 1, new boiler; No. 2, new firebox; No. 3, any new firebox sheet; No. 4, all tubes; No. 5, 2-inch tubes; No. 6, specific repairs. With the exception of No. 6. all repairs include the replacement, or re-turning of the tyres, and general inspection and necessary repairing of all engine parts. Suffixes are used in conjunction with repair classification to indicate work not otherwise specified. These suffixes are: A, denotes wreck; B, denotes initial application of stoker; C, denotes initial application of superheater; D, denotes initial application of valve gear; E, denotes conversion from compound to simple, or vice versa.

For instance, if an engine, after preliminary inspection, is found to require a new set of tubes throughout, and to have a stoker applied, she will be classified as a No. 4B repair, and this symbol will be placed on all charts and correspondence in connection with the work on that particular engine; 2C would in-

DAYS IN SHOP	CHARGE HAND / DATE IN SHOP / OPERATION	Eng. No.		
1	Engine In Shop " Off Wheels			
2	Hydro Test Gen. Stripping Complete			
3	Material Delivered Headers Out			
4	Tubes Out C & V Bushes Insp.			
6	Cyl. Patched			
8	Mountings In C & V Bushes Bored			
9	Binders Up Shoes & Wdgs Laid Off Widths O K			
10	Tubes In Springs & Gear O K Guide Bars Cross Heads			
11	Spring Gear Up Boiler Tested Guides & XHd. Lined Motion & Vs. O K Wheels O K			
12	Engine Wheeled Headers In Motion Hung			
13	Supr. Pipes In " Tested Main & Ecc Rods Tst. Inspirator O K			
14	Valves Set St. & Exh. Pipes In Ash Pan O K			
15	Pistons In Brake Gear O K Brass Work O K			
17	Eng. Trucked Side Rods On Eng. On Trial			
18	Eng. Fin. & Del. Date			

FIG. 3—A SUMMARY FORM OF AN 18-DAY SCHEDULE.

dicate that repairs called for a new firebox and the initial application of a superheater.

The form shown in Fig. 1 is that for the repair engine output. This specifies

the gang and the foreman in whose charge the engine has been placed, and the date the engine is to be delivered. These forms are made out for a period of thirty-one days but are revised weekly to conform to changes necessary in the schedule. These alterations, when necessary, are made after the engine has been a couple of days in the shop. The reason for this is due to the fact that the preliminary inspection does not always disclose the exact nature of the total repairs required. This can only be determined after the hydrostatic test has been made, which is carried out after the motion work has been dismantled and the driving wheels and truck have been removed. This pressure test, together with a closer physical examination, either confirms the first inspection, or brings to light additional defects, the latter invariably being confined to boiler conditions.

In the preliminary inspection the engine may have been classed as a No. 4 repair, but when subjected to the cold water test, may develop further firebox or boiler trouble, calling for the renewal of a firebox or throat sheet, or perhaps an entire new firebox. Should such conditions arise, it becomes necessary to reclassify the engine as a No. 3 or No. 2 repair; in which case readjustment of schedule becomes imperative, so as to coordinate the work of the different departments to which the various parts of the engine have been distributed.

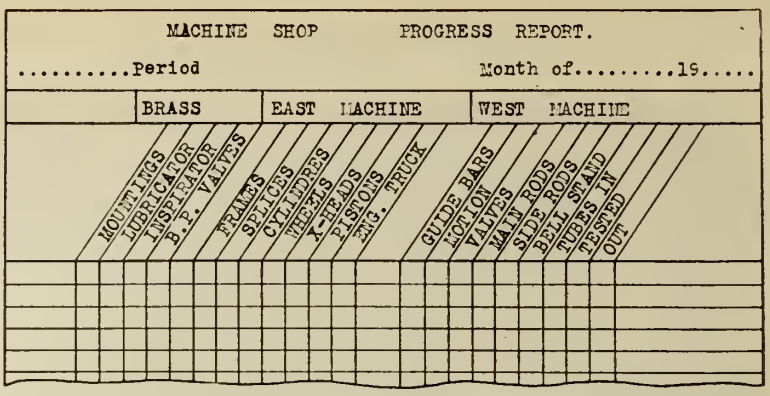


FIG. 5—THIS FORM SERVES AS A CHECK ON THE PROGRESS OF WORK PASSING THROUGH THE MACHINE SHOPS.

Under ordinary conditions locomotive repairs at Angus are based on an eighteen-day schedule. Cases are on record where engines have been overhauled and delivered in fourteen days, but the general time ranges from sixteen to thirty days, depending on the special work required. In every case, the first four days of dismantling and the last seven days of erection are practically identical on all engines, these periods having become fixed items in all repair schedules, The hydro-test on the boiler is the main factor in determining the "in-between-period," as all other repair requirements can usually be classified before the engine enters the shop.

However, once the patient is taken into the hospital and assigned a bed, the true nature of his illness and the character of the operation necessary can only be definitely decided after professional diagnosis and X-ray examination.

When changes are made in repair schedule, due to the developments of additional defects, it necessitates prompt action on the part of the schedule department in notifying all divisions of the shop that this particular engine has been "set back"; that is, her delivery date has been extended to conform to the new conditions. If this means that a delay of several days will be necessary, work on detail repairs on that engine must be suspended and the effort directed to work that is required. It is useless to provide clothes for a sick man until he is well enough to put them on. It might



TUNING UP THE LOCOMOTIVE BEFORE GOING ON A RUNNING TEST.

be said that it is good policy to have the garments ready. This would be true if it was not for the fact that another man was being kept in bed a day or two longer because his clothes were not at hand. Idle locomotives are items of expense on a railroad company's cost sheets. In order, therefore, to maintain the monthly output from the shop, it is necessary to so arrange the incoming engines that ample provision may be made for extended repairs to one previously taken in.

When an engine has been "set back" on schedule another one is advanced, and the different departments are advised as to the changes effected. The small form shown in Fig. 2 is used for this purpose.

On the ordinary repair, detail work on certain engines is carried on simultaneously in all departments during the period of dismantling and the erection date for each particular piece of equipment. A summary of an eighteen-day schedule is shown in Fig. 3, this representing a No. 4 repair. The first four days' work, which is the same for all engines, comprises: First day—taking the engine in the shop, hoisting the engine and removing the wheels; second day—cold water test and general stripping operations; third day—material and parts delivered to different departments and the headers taken out; fourth day—tubes taken out and cylinder and valve bushes inspected. For the next seven days repair work is proceeding in each and every department so that on the eleventh day—or in the case of more extensive repairs, on the seventh day prior to scheduled date of engine delivery—work is started on reassembly and erection, which on the form here shown is being performed on the dates included between the eleventh and the eighteenth day, the latter corresponding to the date on which the engine is again placed in commission.

EAST MACHINE SHOP.

DELIVERY DATES OF MATERIAL TO ERECTING SHOP.

Week Ending Jan. 10th. 1920.

Date.	Crossheads.	Wheels.	Pistons.	Eng. Trucks.	Idler Whls.
Still Due	5805 2115	2518		1077 2518	
1-5	3936	5805M. D. 2115	5805 2115	5805	5805
6	790 6113	3936 2508	3014	2115	
7	3388 5755	5805 377	3936 2508	3936 2508	2508
8	5806	790	377	377	
13	3040	746	3388 5755	5806. 746	5806

#3 Repairs.

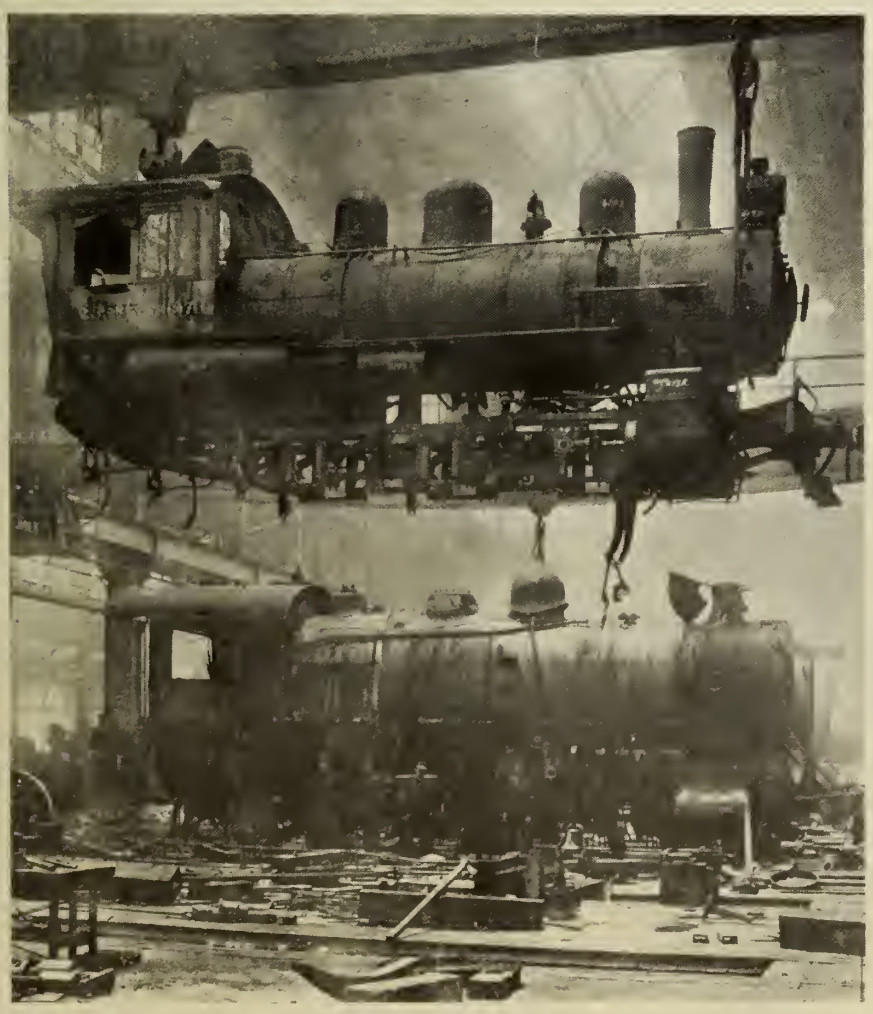
Engine	3419	Due Out	1-6-20
	711	" "	1-7-20
	2538	" "	1-8-20
	5754	" "	1-9-20
	3043	" "	1-13-20

FIG. 7—THIS FORM SHOWS DELIVERY DATES OF MATERIAL TO ERECTING SHOP.

In order that the entire program of repairs may proceed with uniform regularity and insure delivery to the erection shop on or before the date specified, progress sheets are kept constantly up to date, so that a glance at the day's report will show the actual conditions as they exist. If any particular department has "fallen down" on the schedule, the schedule man loses no time in making an investigation, with the result that the cause of the delay is located, reported, and recorded, and immediate steps taken to remedy the trouble. A portion of one of these progress sheets (for the week ending Dec. 4) is shown in Fig. 4. Every shop foreman, and every other department head, is given one of these sheets, so that he is constantly advised of changes in the schedule and the delivery date of each engine. This enables him to so regulate his work that his own shop schedule will not fall behind, unless it be for causes beyond his control; in which case the schedule man has knowledge of it before it is a day old, and every effort is made to adjust the irregularity. The responsibility of this adjustment is one of the routine features of the production department.

The form shown in Fig. 5 serves as a check on the progress of the work pass-

No, You Are Not Seeing Double. These Are Two Different Locomotives



THIS IS THE MODERN METHOD OF HOISTING LOCOMOTIVES.

ANGUS SHOPS LOCOMOTIVE SCHEDULE OFFICE.

RECORD OF MATERIAL DELIVERED FROM WEST MACHINE TO ERECTING SHOP.

MATERIAL. \ Eng. No.																		
Back Valve Cover																		
Bell Stand																		
Combination Levers																		
Crosshead Arms																		
Dry Pipe																		
Dome Pot																		
Eccentric																		
Fire Door																		
.....																		
.....																		

FIG. 6—A RECORD OF MATERIAL DELIVERED FROM THE MACHINE SHOP TO ERECTING SHOP.

ing through the machine shops. Provision is made for thirty-two engines and check marks are made in the small squares when machine work on that specific part has been completed. These progress sheets are collected daily by the schedule man and the progress recorded on the reference charts kept in the office of the supervisor of production. A section of the form used for recording the date of delivery of finished material from the West machine shop to the erecting shop is shown in Fig. 6. The material list contains 38 separate items, these being component parts of the equipment shown in the third division of the machine shop progress report. In conjunction with the two last mentioned reports, loose-leaf, letter size, typewritten reports are compiled for the current week, showing the delivery dates to the erecting shop, of the various units for all engines on that week's schedule. Included in the report is the equipment still due and also what is required for the first two days of the following week; this latter serves as a guide when making up the report for the next period. Appended to this report is a list of the engines due to be completed that week. This form is shown in Fig. 7.

When new cylinders are required in the specified repairs to an engine, the production of these is so scheduled that they will be cast, machined, and delivered to the erecting shop at the proper time for reassembly. The charge hand has no personal worries as to where he will get the work, does not require to visit the machine shop to see if the cylinder is ready, nor has he to take the responsibility of getting the cylinder to the erecting shop after the work is done. Every detail, apart from the actual duties of the men, is taken care of by the production department.

The form used for grey iron foundry work on cylinders is shown in Fig. 8. This gives the requisition number, pattern number, engine or shop order number, and the various operations necessary in the making and cleaning of the casting. This schedule provides for delivery of the rough cylinder to the machine shop, eight working days after the order has been given to the foundry foreman. If it should so happen that the shaking out takes place on a Saturday, the cooling would take place over the week end, and in this way one full day would be saved

In every branch of repair work carried on at Angus, the object has been to so co-ordinate the tasks of the various departments that a spirit of harmony pervades the entire organization. As the inauguration of the present system proceeded it became more and more evident to all foremen and supervisors, that because certain of their duties (which might be classified as clerical duties) were transferred to the production department they suffered no loss of prestige or position, and the real effect was to enable the foremen to spend more time in their shops in supervising the men, getting out the required work and doing it right.

The production department acts in the capacity of a clearing house for shops' information on output, and it obviously follows that the routing of work and the tracing of material to the shops can be better done by specialists than by foremen whose time can be spent to better advantage in the shops.

ANGUS SHOP SCHEDULE DEPARTMENT.

GREY IRON- FOUNDRY CYLINDER SCHEDULE.

REQN. No.	PATTn. No,	Eng. or S/O No,	Core I. Cast	Cores Made	Ram-Up Box	Pour Cstg.	Shake Out	Cool Cstg.	Clean Cstg.	Del. to Shop

FIG. 8—THE FORM USED FOR GREY IRON FOUNDRY WORK ON CYLINDERS.

A Score Board to *Prevent* Accidents

How the Dodge Mfg. Co. Have Secured the Co-operation of Their Men in an Effort to Keep Down the Number of Accidents —Falling Off in the Hours Lost Through Injuries to Workmen

By HARRY BOTSFORD, Dodge Mfg. Co.

IT has been eight years since the Dodge Manufacturing Company of Mishawaka, Indiana, first started its accident score board. During this period we have answered thousands of letters from firms all over the United States asking for methods of operation, explanations and comparisons. Believing that our method is unique, interesting and worth-while, we are glad to give other manufacturers our experience with our sign board.

In the first place when the sign board was erected and planned there was no thought of the pioneering work that the Dodge Manufacturing Company was doing in welfare work. Our sole idea was to develop some means of cutting down preventable accidents in every department in our plant. W. L. Chandler, our Supervisor of Insurance, decided the best plan to do this would probably be to make use of a competitive spirit in workmen and foremen. Today, after eight years of operation, the score board is as much a pride to the worker-personnel as is a record-breaking pulley or transmission equipment. One represents an achievement in human conservation and the other marks a mile stone in mechanical progress—both of which are vitally essential.

The size of the board as we erected it just inside the main gate of our No. 1 plant was 17 feet x 24 feet, which gave plenty of room for large lettering. The mechanism for scoring points is as simple and fair as possible. The starting point is 1000, both for year and for month; each division is penalized according to its accidents; each day's absence bears a percentage charge in proportion to the total number of "men-days" per month per division.

How Factory Is Divided

Our departments were divided into 26 divisions, according to the various degrees of natural hazard of variation in numbers of men employed. The degree of hazard is disregarded in our business which covers the same general subject throughout the plant; the differentiation being considered as equalized in the choice or selection of men with reference to their ability and fitness for their respective class of work.

As to the variation in the sizes and groups of workers, we set this by establishing a differential charge per man per day for time off—which is computed by reducing each



Number Dept	Name Department	Name Foreman	Deduction For Absence	Percentage Month	Percentage Year to Date	Rank For Month	Rank For Year to Date
FOUNDRIES							
30	CUPOLA & YARDS	L. KING.	19	1000	1000	1	1
17	CORE ROOM	G. SCHNAU.	10	1000	1000	1	1
12	SOUTH	W. MIDDLETON	7.5	1000	1000	1	1
15	HANGER	G. F. LONG.	14	986	983	5	17
14	PULLEY	J. BICKEL.	16	1000	991	1	11
18	PATTERN	E. GARTNER.	38	1000	1000	1	1
16	CHIPPING	J. STUFF.	6.	994	999	2	15
MACHINE SHOP							
5	BEARING	J. MILLER.	15.5	1000	996	1	6
3	SHEAVE	R. PRIEM.	20.	1000	995	1	9
3A	MACHINE	J. ROUGH	28.	1000	1000	1	1
3B	ERECTING	J. GONICK	19.	1000	994	1	8
4	SHAFTING	W. MOURTS.	32.	1000	1000	1	1
6	CLUTCH	T. KENYON	10.	1000	999	1	2
2	IRON PULLEY	G. FRIEDMAN.	10.	1000	9918	1	10
20	TOOL	G. PETERSON.	28.	1000	991	1	14
WOOD SHOP							
1-A	SEGMENT	F. YOST.	115	1000	997	1	5
1-B	ARM	J. PHILION	32.	1000	949	1	16
1-C	ASSEMBLING	C. MARSH	7.7	1000	993	1	9
1-D	FINISHING	C. DeGROOTE	28	1000	1000	1	1
OTHER DEPARTMENTS							
7	STEEL SHOP	G. HUNT	13.5	892	991	9	12
27	INSPECTION	G. McNEAL	52.	1000	1000	1	1
25	SHIPPING	G. SHOBE.	8.7	1000	996	1	4
21	YARD & SAW MILL	E. DILS	11.	1000	998	1	3
23	POWER	W. TUPPER	38.	1000	1000	1	1
22	MILLWRIGHT	S. BRUBAKER	26.	1000	991	1	13
19	METAL PATTERN	O. FORD	104.	1000	1000	1	1

This is the score-board used in the Dodge plant. It is not an experiment, but a plan that has been in operation for many months, and the firm is so thoroughly convinced it is all right that they are anxious to pass it along to others, recommending it as workable and profitable.

AGENTS FOR
Messrs. Sir W. G. Armstrong, Whitworth & Co. Ltd., Eng.
Messrs. Armstrong & Main, Ltd.
Constructional Engineers, Glasgow.
Messrs. Cromptons Ltd.
Electrical Engineers, London.
Messrs. Armstrong Siddeley
Motor Cars, Coventry.

A

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Messrs. Pearson & Knowles Ltd.
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Messrs. Rylands Ltd.
Wire Rope Manufacturers
Warrington.

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BORING MILLS
ETC.

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Maximum Efficiency

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division to men-days for each month, and using a multiplier of 10 to raise the figures to a more workable and understandable basis.

This system of scoring was finally arrived at after considerable experimental work and the present system seems to be fair in every respect and we have had no occasion to change it during the past few years in spite of the fact that during this time almost every known condition has cropped up.

In the fourth column of this score board will be noticed the figures which represent deductions for absence in that division.

Perhaps we have been too tolerant of the minor accidents which do not necessarily entail the loss of an appreciable length of time, as we do not penalize for any loss of time on the day of the accident. It is possible, however, by this means to secure a prompt report of all accidents, however small, so that we may be sure of proper attendance, and avoid, as far as possible, such suffering as may be otherwise charged to secrecy on the part of either men or division superintendents.

The Reward Comes Each Year

At the end of each year the employees of the divisions scoring 1000 receive two days extra pay, or such part of that amount as their time and employment bears to a full year. If none score 1000, then the highest ranking division receive the two days pay. General foremen of any division under them earning these premiums also participate on the same basis, but may earn but one prize if other divisions under them make a perfect score.

Our original plan was to distribute $25 in cash each month to all foremen of divisions winning perfect scores, but due to the relative importance and the efforts of the foremen with a widely varying number of men to deal with, we were, in all fairness, obliged to change this arrangement so that one-half of each prize is paid on a flat basis and one-half distributed according to the number of men overseen; thus a foreman in charge of 50 men will get a proportionately larger premium than the one in charge of 10 men.

It will be noted that the cash prize is small, and to some it may be even considered as trivial, but it was our intention not to make the men strive only to secure the cash prize as much as to awaken in them a healthy competitive spirit. In this we have succeeded beyond our fondest hopes for the competition is keen and constant.

Every member of each division is keenly alive to the fact that responsibility for keeping his division with a perfect score rests squarely on him—consequently, he gauges his work and actions to conform with all the precepts of safety-first. This interest is stimulated and fostered by making up the yearly basis out of the monthly average. The great thought is then concentrated on the yearly contest, and the discouragement of any unfavorable monthly showing is avoided because any other division may have a penalty sufficient in some months throughout the year to equalize these unfavorable periodical conditions.

Competition Is Often Keen

So keen does the competition become that more than once considerable tact and diplomacy had to be used in some divisions where the carelessness of an individual caused a disabling accident.

As a means of preventing accidents the score board has rendered excellent service for us. It is no uncommon occurrence to have 10 divisions out of 26 showing perfect scores. Included in some of our perfect scores is our Steel Foundry where we make castings weighing as high as 50 tons. This work is usually classed as hazardous.

Some divisions have perfect scores year after year and there is hardly a single division that has not shown marked decrease in accidents during the past eight years.

In addition to the sign board we also maintain a safety first organization among our workers that deserves much credit for our extremely low accident experience in our many departments. We unquestionably recommend our plan to any manufacturer, and know any organization will find a similar plan to be well worth while.

Metal That Lubricates Itself

Now comes an inventor who says he has a metal which will run hot and which will not "seize" because he has found a way of combining graphite with it, so comments Popular Science Monthly. This is probably the first time that any one has succeeded in combining a non-metal with a metal. An alloy of aluminum and graphite is said to give better results than the usual phosphor-bronze-bearing alloy at the same speed and pressure.

Substitute for Copper

During the war Germany was hard pressed for copper electric conductors, and Von Bett, a physicist, suggested that sodium would be an acceptable substitute.

The conductivity of sodium is about equal to that of zinc and about one-third that of copper, but since the specific gravity of sodium is small, it is a better conductor, weight for weight, than any metal.

On the other hand, sodium has a very low melting point and cannot be drawn into wire. Moreover, it cannot be exposed to the air.

The experiment was made of filling thin-walled iron tubes, painted as a protection against rust, with fluid sodium, and it was successful.

Whether or not such conductors as these can be introduced commercially depends upon the possibility of drawing the tubes cheaply. Sodium is now made cheaply from common table salt by electrolysis.

The exportation of Portuguese salt before the war was chiefly to the Netherlands, France, Newfoundland, Norway, Sweden, and Ireland, says Engineer. After the war conditions changed; the Netherlands, Sweden, and Norway now buy mineral salt from Germany, and France makes its purchases from England. According to the American Consul-General at Lisbon, the annual production of salt in Portugal for export is 150,000 to 200,000 tons. The stocks of 1917 and 1918 are still unsold. In Norway the importation of salt will be eliminted soon, owing to the building of large electrical sea water evaporating plants for obtaining salt direct from the sea. The representatives of the Portuguese salt industry have called the attention of the Government to their difficulties.

In a paper recently read before the Institution of Automobile Engineers, Mr. B. H. Thomas gave some particulars concerning the repair of worn motor parts by means of electrically deposited iron. He stated that the bath that gave the most satisfactory results, was composed of 75 grammes of ferrous ammonium sulphate to 1 litre of water, with a current density of 1 amp. per 30 square centimetres. The work is suspended in the vat from a standard fixed to the bench and in order to ensure a uniform deposit the anode is moved about the work by means of a small motor. The best anode proved to be that made up of 16 S.W.G. Swedish iron wire wound into the form of a cylinder and thoroughly annealed. The temperature of the solution should be kept above 68 deg. Fah., and it is desirable to decant and settle it every three days or so to remove oxides of foreign matter, which cause roughness in the deposited metal

Looking Over the *Shipping* Situation



By T. H. FENNER, Editor Marine Engineering of Canada

LOOKING back over the past twelve months' activities in the maritime world they cannot be said to have been without interest, in fact in some ways they have been spectacular, but have gradually been slowing down as the year wore on, until now shipping has entered the doldrums. How long it will tack about there before catching the first whisper of the wind of prosperity, depends upon a number of factors, the chief and most uncertain one being the time when the world will settle down to work and produce.

The expected slump in freight rates has materialised, and as the writer has pointed out in previous articles, the more inexperienced among the operators of shipping have felt the pinch the most. At the same time, passenger rates have kept up their previous high level, and have in many cases advanced, and that they will keep this advance up, is most probable. The conditions governing in the freight world are altogether reversed in the case of the passenger vessels. In the shipbuilding trade, work is also falling off, after the gigantic efforts put forth by various nations during the past two years, and in many cases plants which cost millions to put down are practically abandoned, and of no use to anyone at the present time. In Canada, the year has been marked by the failure of some of the yards, and the prospects for the future are at the moment, none too bright. The position of shipping all over the world is that of passing through a period of depression, and its effect is shown in falling freights, cancellation of building contracts, and in the laying up of vessels to wait for better times. The passing of the legislation known as the Jones Act in the United States was attended with much excitement, but inasmuch as its provisions have not yet been put into force, and are probably destined to be shelved, matters are being left in status quo for the meantime. The United States Shipping Board has at the moment probably enough troubles on its hands to suit even its fire-eating chairman, Admiral Benson, who has been reappointed. France has found the possession of a Government owned fleet not an unmixed blessing and is considering ways and means of getting rid of it to private owners. The blighting hand of the Government is being gradually moved from British shipping, but the Ministry of Shipping still survives, much to the disgust of the shipowning fraternity, who are anxious to be unfettered in their efforts to rehabilitate themselves. If the events of the past twelve months have shown one thing more clearly than another, it is that a Government is incapable of carrying on a commercial adventure such as operating ships or railways. The good showing of the C.G.M.M. up to the present has been largely due to the fact that practical shipping men were appointed to the executive positions, and the Government left the management of the fleet in their hands. The management have shown their strong commonsense by linking up the C.G.M.M. with some of the strongest and most powerful lines in the old country, by which arrangement they are sure of the best facilities in the various ports abroad and in the U. K., and are also assured of valuable feeders for cargo at outside points where a new line would have great difficulty in getting a look in. Such is the general state of affairs at this time of writing, and it will be profitable and instructive to look a little more closely into details.

The World's Tonnage

We have heard a great deal of late about the tonnage of the world being greater than in the pre-war days of 1914. This is true, but it does not take into account the natural increase that would have taken place in normal times, nor the fact that a lot of tonnage is very old, and in some cases almost obsolete. There has been a very large amount of reconditioning carried out during the past year, many vessels which had no overhaul during the strenuous days of the war having been taken out of commission and re-fitted completely. Another feature is that for a long period following the armistice the efficiency of the shipping in use was very low.

This was due to congestion in the various world ports, necessitating long waits for unloading, and loading again. The congestion was caused in a great measure by restrictive methods pursued by labor, and by the natural difficulty in clearing warehouses and storage sheds from the accumulation of merchandise that had piled up during the period of Government control. The breakdown of land transportation during the same period contributed also to the general tie-up.

This condition is being cleared up now, but is still bad in spots. The result of all this was that many ships were actually in their loading and discharging ports for a greater period than they were actually on the voyage between ports. This meant that there were too few ships to carry on the business, and the costs being so high, freights went up by leaps and bounds to cover these extra costs.

Owing to poor fuel, and general rundownness, ships took longer to cover the same mileage than in normal times, and

all these factors contributed to make the efficiency of the merchant fleet very low. Another point is that a large percentage of the increase in the world's tonnage is represented by wooden vessels, which are mostly tied up at the present day, and represent a dead loss to their owners. The United States Shipping Board possesses about $200,000,000 worth of these vessels, which they can neither operate, sell, or even give away.

What the Figures Show

Comparing the figures for 1914 with those of the present day we see some points of interest. The totals are taken from Lloyd's Register of Shipping, which is the world authority on the matter. Vessels of less than 100 gross tons are not included, neither are warships. In 1914 the world possessed a total of 45,404,000 gross tons. The total in June, 1920, was 53,905,000, or a total increase of 8,501,000 tons. The relative position of the great shipowning nations has materially altered. For instance, in 1914 the United Kingdom had 18,892,000 tons, while the United States had only 4,287,000, including all her Great Lake craft. The percentage of the world's tonnage owned in the United Kingdom was 43.9, while that of the U. S. was 4.7. At the present day the percentage of the United Kingdom has decreased to 35.1, while the United States has increased to 24. The increase in the other countries has practically all taken place since the closing of the armistice, during which period the increase in the world's shipping has amounted to over 6,000,000 tons. By carefully estimating the net increase in the tonnage of the various nations, and eliminating all wooden and iron tonnage, the compilers of the Registry arrive at the conclusion that the world is still 3½ million tons to the bad as far as steel steamers are concerned. This effectually disposes of the claim that there is too much tonnage afloat.

Great Britain Still Building

The outstanding feature of the shipbuilding situation has been the increase in the number of vessels now under construction in the United Kingdom, and the decrease of those under construction in the United States. The building programme of the U.S. is now about finished. The same thing applies to the construction in Canada.

The following figures for the quarters ending March 31, June 30th and September 30th will give a good idea of the progress of events. There is no doubt that the immense amount of reconstruction work undertaken in the United Kingdom, as well as the dilatory attitude of labor, has kept production of new tonnage down, but even at that a very steady increase is noted.

In the quarter ending March 31st, the amount of new construction under weigh in the United Kingdom was 3,394,425 tons. This was made up as follows 814 steel steamers, 7 ferro-concrete, and 4 wood and composite steamers. There were also 35 steel sailing vessels, 4 ferro-concrete vessels and one wood and composite ship. In the United States at the same date there were 450 steel steamers, 29 wooden steamers, 10 steel sailing vessels, and 46 wooden sailing vessels, or a total of 535 vessels of all kinds, with a total tonnage of 2,573,298 tons. In Canada at the same date there were 50 steel steamers, or a total tonnage of 157,000 tons under construction.

Many Large Carriers Built

A notable feature of the steamers under construction in the United Kingdom was that there were 62 steamers of over 10,000 tons included. These were made up of 10 between 10,000 and 12,000 tons, 29 between 12,000 and 15,000 tons, 20 between 15,000 and 20,000 tons, and three between 20 and 25,000 tons. These vessels were mostly of the purely cargo, or the combined cargo and passenger type, very few companies building the purely passenger liner class of vessel.

In the following quarter, that ending June 30th, the figures altered to the advantage of the United Kingdom steel steamers were 888, ferro-concrete 3, and wood or composite 4. The sailing vessels were, steel 41, ferro-concrete 3, and wood or composite 2. The tonnage represented was 3,388,000. In the United States the steamers had fallen to 366 of steel, 18 of wood, while the sailing vessels were 15 steel and 16 wood. The total tonnage represented was 2,105,956. In Canada the tonnage under construction was 58 steel steamers, and 12 wooden steamers, and 14 wooden sailing ships. The total tonnage was just over 200,000. In Great Britain the steamers over 10,000 had gone up to 63, nine of them being between ten and twelve thousand, thirty-one between 12,000 and 15,000, the remainder being the same as in the previous quarter. The peak of Canadian building for the year had been reached in this quarter, as the next quarter shows a drop in the number and tonnage of the vessels on the stocks and being completed.



THIS VESSEL MARKED A GREAT DEVEVLOPMENT IN SHIPBUILDING. SHE IS ENTIRELY ELECTRIC WELDED AND FITTED WITH AN OPPOSED PISTON INTERNAL COMBUSTION ENGINE DESIGNED BY CAMMEL, LAIRD & CO.

The figures for the quarter ending December will of course show this still more, but they are not yet available.

What Other Periods Show

The quarter ending September 30th shows a still higher figure for Great Britain, and a further drop in the U.S. Thus the steel steamers in the United Kingdom numbered 912, ferro-concrete 5, and wood or composite 4. Their total tonnage was 3,720,000 while sailing vessel tonnage made another 11,000.

United States figures are 260 steel steamers, with a total tonnage of 1,734,000, wooden steamers being 12 of 18,000 tons and ten each of wooden and steel sailing vessels of 18,000 tons. There is thus a considerable decrease in the number and tonnage of all vessels building in the United States. In Canada the number of steel steamers had decreased to 46, with a tonnage of 158,000, three wooden steamers with a tonnage of only 1,057, and 15 wooden sailing vessels of a tonnage amounting to 11,000. Thus the figures show the gradual rise of British shipbuilding and the falling off of United States shipbuilding. The cause of the decrease, both in the U. S. and Canada is of course the completion of the Government building programmes. The United States now has a fleet of sea going merchant vessels operated partly by the Shipping Board and in part by private firms who have been allocated tonnage by the board. A large number of the vessels which were under private management have been handed back to the Shipping Board since the freight market fell in, and the Board has laid up a large number of their vessels which they have been unable to fix.

The United States Merchant Fleet

Probably the events of most interest in the year's operation of the now merchant marine in the United States, has been the passing of the Jones Act and the investigation of the Shipping Board. The Jones Act is the name given to the legislation introduced by Senator Jones, which had as its avowed object the bolstering up of the new merchant fleet against competition by the nations which were doing the most of the carrying trade. Chiefly, it was directed against Great Britain. The untoward events of the last five years having resulted in Great Britain losing a great portion of her shipping in the service, and for the benefit of the rest of the world, and the United States having become possessed, at enormous expense, of a more or less efficient fleet, it was felt by the Senator and those associated with him, that something had to be done to ensure its ability to live. Legislation passed in former years by Senator La Follette has resulted in making the ships of the U. S. the most expensive in the world to operate. This was on account of the extraordinary accommodation and living standard set for the U. S. seaman, and when this was coupled to the necessity of paying overtime for every little job that was done out of the regular routine, running ships at a profit even during the era of high freights was a problem.

It was not an uncommon thing for a Shipping Board vessel to arrive in a United States port with the bill for overtime to the crew totalling more than the actual wages, which themselves are very high.

Preference for U. S. Shipping

The method employed and backed by Admiral Benson, chairman of the Shipping Board, was to pass legislation by which all goods imported or exported to or from the U. S. in American ships should receive a preferential rate on the railroads, and also a preferential tariff. This meant that treaties in force with some twenty-nine other nations would have to be abrogated before this legislation could be put into operation. President Wilson, who even if he is an idealist, has a larger view than some of the U.S. senators, refused to give his assent to the bill, and it has hung fire ever since. It was not universally acclaimed even in the United States, the port of Seattle registering a very violent protest against its adoption. In reply to this Admiral Benson issued a statement that the protest was engineered by alien enemies of the United States, who wished harm to the new fleet, and threatened the port of Seattle with drastic punishment if their protests did not cease.

The claim of the Western seaport was that the bill, if put into effect, would ruin their trade. However, Admiral Benson has been made Chairman of the reconstituted Board, and with the coming into office of a new administration, pledged to further the interests of the U. S. mercantile marine against all comers, there will likely be some interesting developments in 1921. It is noteworthy that the British shipping press hail with satisfaction the reappointment of the bellicose Admiral, as if they feel that no worse harm could come to the Shipping Board fleet than having him in control.

What the Inquiries Showed

The investigation into the activities of the United States Shipping Board was undertaken by two former officers of the Board, and they have so far found that the Board committed everything but murder. Such things as incompetency, ignorance, graft, etc., are charged in connection with all its activities, and if half the charges are true, one can only sympathize with the great American nation. If half the blunders and mistakes that are charged could be committed by any body of presumably big business men in that land where efficiency is supposed to roost on the same perch as the eagle, how ever could any ordinary body of men be expected to succeed? The British press, which is naturally highly interested, is of the opinion that a lot of the charges are due to pre-election vigor. They take the view that when a totally inexperienced body like the U. S. Government take on a job like the building and operating of a huge merchant fleet, there were bound to be lots of mistakes, and the charges of graft they dismiss as due to the zeal of the investigators.

Competition Has Cut Rates

The vessels of the fleet have been put on various routes during the year, and have been in some cases responsible for the lowering of rates at a sudden clip. For instance, during the coal strike in England, when a new business in export coal sprang up suddenly from the Virginia ports, the board put such a number of ships on the trade that freight rates dropped rapidly. They also insisted on seeing the charter of any ships other than their own, American or foreign, so that they were in a position to know just what everybody else was doing, which of course gave them a considerable advantage. The deal by which Mr. Harriman has arranged a service between Hamburg and New York in connection with the old Hamburg-American line was consummated under the supervision of and with the consent of the Shipping Board. This gives the ships of the American corporation the advantages of Hamburg-American organization in Hamburg, but it also, in the opinion of a large number of people, gives the Hamburg-American line the entering wedge which they are looking for, in resuming active competition with the vessels of their erstwhile enemy. It is rather a peculiar thing that with the country still technically at war with the U. S., business arrangements can be made between German and American citizens, with the active help of a department of the American Government.

British Shipping

British shipping has been fighting its way back to its old time trades against a combination of handicaps which might well discourage any industry. The shipowners have been put to all kinds of inconvenience and expense by Government departments, notably the Ministry of Shipping, which having been created during the war, is doing its best to perpetuate a useless life. The Government has promised that its activities will shortly be discontinued, but it still drags on, and affords a proof if such were needed, of how hard it is to make men give up the easy hours and emoluments of a Government position, even when there is no possible excuse for their retaining them. The large liner companies have been reconditioning their ships, and getting them back on the routes, but it is notable that no companies are going in for the large fast passenger liner. Costs of building and operation have increased to such a point that the liner de luxe is a commercial impossibility.

Change in "Style" of Vessels

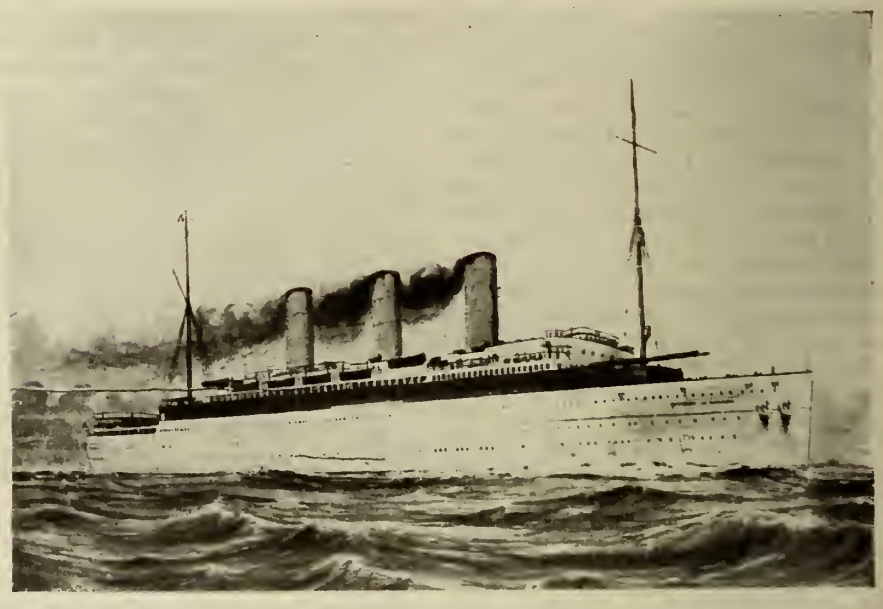
The type of vessel in favor now is the moderate size and moderate speed vessel that can give good accommodation to a fair number of passengers while carrying a large cargo. The shipowning business has been very badly hit by the low production of coal, and the embargoes placed on the export of coal to foreign countries, and the export of bunker coal. It is of course well known that the bulk of the steamers leaving England in the past have had cargoes of coal, which they took to all parts of the world, bringing back the produce of those countries. The coal formed outward freight and also created credits to pay for the goods brought back to the United Kingdom from other countries. The attitude of the coal miners in restraining production of coal, and the vexatious delays and restrictions placed on steamers by the Government department which has control of coal, has resulted in vessels having to leave England in ballast, to make long voyages in many cases, in order to get a return cargo. This resulted in high freight rates, which made the price of all goods brought back still dearer to the people in England.

During the coal strike, coal was actually imported to Britain, but worse still, the market in France and the Mediterreanen which had always been supplied by Britain was opened to her competitors.

Building Costs are Away Up

Costs of shipbuilding have gone to such a pitch that many firms have paid large sums to cancel the contracts for ships they had under construction, rather than continue with them and have to pay an exhorbitant price. With falling freights, it is impossible to run the ships at a profit when the capital cost is abnormally high. In this connection some very straight words have recently been delivered to the workmen in the British yards. They have been told plainly that they are hanging back and not delivering an hour's work for an hour's pay, and that if this continues they will soon be without a job of any kind. A very serious side of the high cost, and not only the high cost, but the altogether unnecessary length of time taken is that it has resulted in a large amount of repair work being sent to the Continent that should have been done in the United Kingdom. A number of contracts for ships received from Norwegian and other foreign shipowners have been cancelled, but this is probably not so much a matter of high costs, as the slump in freights, which make it appear a bad time to acquire new tonnage. At a recent launch of a Cunard steamer, the Chairman of the company said that the vessel was six months late in delivery, and had cost in excess of her estimated cost a matter of nearly $3,000,000. This sort of thing is naturally a big handicap. There is one thing that is to be said as far as the British shipowners are concerned, they have been through hard times before, and know just how to face them, and where to squeeze a living for a ship if it can be done.

If labor will assume anything like a reasonable attitude, especially the men actually sailing the ships, Great Britain will pull through the present depression in better shape than most of her competitors, and be on hand when the good period comes round again. There is no doubt that if the world in general were functioning properly, there would be ample work for all the ships at present afloat, and for a good many more. The elimination of a huge country like Russia from the trading field of the world has had a disastrous effect on many other countries, and the low rate of foreign exchange has also been a handicap on trading. British shipowners generally ask for nothing but a relief from the irritating restrictions of incompetent and stupid Government officials, and then they feel they can meet competition as they have hitherto done, and beat it.



ONE OF THE LATEST C.P.O.S. EMPRESSES—THE "EMPRESS OF CANADA."

Canada's Shipping and Ship-building

The past has been a busy year for Canada, both in her shipbuilding yards and on the high seas. Besides the ships that have been built for the Canadian Government Merchant Marine there have been a few built for export, and there is no doubt that there could be more export orders secured if there was any method of overcoming the exchange rate handicap. It has been rumored on several occasions that large orders have been secured for vessels for export, but these have not materialized. A suggestion was made during the year that the Government should finance the building of ships for foreign order, taking a mortgage on the vessel as security. This was finally agreed to by the Government, but up to the present no orders have materialized under this arrangement. Shipbuilders claim that the proportion of the cost of construction that would be advanced by the Government should be about 50% instead of the 25% they suggest. At the present time building is active at Halifax, Levis, Three Rivers, and Port Arthur and Collingwood. Some of the Pacific coast yards are also building vessels.

At to the outlook for the future we quote the opinion of one of the leading men in the industry, which should be of interest as coming from a practical shipbuilder, who knows whereof he speaks. The gentleman in question is Mr. C. M. Gillam, managing director of Canadian Vickers Ltd., who speaks as follows:

"During the past year the supply of materials, especially steel, was considerably handicapped by the labor troubles in the States in the railroad and mining industries, but this condition has much improved in the past few months. The tendency now as regards prices is downwards in practically all commodities. The supply of materials is distinctly good and promises to improve.

"There is an ample supply of labor and its efficiency has shown a steady improvement, although the wages which gradually increased during the past years to meet the increased cost of living, still remain at a high figure. In this connection it is confidently hoped that as the cost of living improves the saner elements in labor will be able to guide their less informed brothers, realizing that a reduction in labor costs is essential if business is to be obtained in competition with European countries.

"In the shipbuilding industry there is a serious falling off in the number of employes, due to lack of orders for 1921. The cause of this is the adverse exchange rate and the fact that the Canadian Government shipbuilding programme has come to an end. There is no market in the

United States for Canadian built ships due to the financial inducements offered by the United States Government to United States owners to build their vessels in the States. The consequence is that the only market for Canadian shipbuilding at present is Europe and, as stated above, the exchange rate is sufficiently high to prevent business.

"With reduction in prices of materials and increasing efficiency of labor, prices asked for in Canada for ships are steadily coming down, and it is confidently predicted that, with the further reduction, both in wages and materials, anticipated in the near future, such prices will be so reduced as to enable Canada, apart from the exchange question, to compete to advantage in the open markets of the world. This is the only feature which justifies the hope that, as exchange becomes normal, there will continue to be a limited shipbuilding industry in Canada which can operate on a commercially sound basis.

"It should be noted in this connection that the cost of construction of ships in Canada is not materially higher than the present cost in England when the exchange situation is left out of account, although it must not be forgotten that there will undoubtedly be a tendency towards cheaper production in England when labor conditions there become more settled, although there is no likelihood of wages in Great Britain ever being reduced to pre-war rates.

"It is worthy of note that, roughly speaking, 50% of the business of Canadian Vickers, Limited, in shipbuilding has been for export, and the performances of ships built by them for foreign countries has more than justified the confidence in the ability of Canadian workmen and Canadian shipbuilders to turn out ships in all respects equal to those of any other country.

"The outlook for 1921 is not bright at present, so far as shipbuilding is concerned, but the basic factors, namely—efficiency of labor, the drop in price of materials, and the recognition by labor of the economic situation and willingness on their part to co-operate to overcome the adverse features, are such that a pessimistic cessation of effort to overcome these difficulties and to tide over the dull period is not justified, but a more vigorous attempt is necessary on the part of the Government and employers towards finding means by which the industry may be kept alive until exchange becomes normal and the Canadian shipbuilding industry has a real chance to continue on its own merits.

"In conclusion, in our opinion the present situation of the shipbuilding industry is such that, provided the difficulty of exchange which, after all, is an abnormal one due to the war, can be overcome by means of assistance from the Government or otherwise, there is every reason to believe that shipbuilding in Canada can continue as a profitable commercial business."

The Canadian Government Fleet

Our Canadian Government fleet has extended its activities during the year until now it is on every route in the British empire. Vessels are sailing from Halifax and St. John, N.B., in the winter, and Montreal and Quebec in the summer to Newfoundland, Liverpool, European Continental ports, British West Indies, and South America, while they are sailing to the East Indies and China from both the East and West coasts. The vessels are a fine type of ship, well found, with good accommodation for officers and crew, and in the later ships extra accommodation has been provided for three or four passengers. On the ships in the Australian service refrigerating space will be provided, as well as the domestic refrigeration that is fitted in most of them. The writer, who spent a good many years at sea, has never seen ships with such comfortable crew accommodation as these Canadian vessels, and it is a credit to their designers. The fleet, as we have had occasion to mention on several occasions, is managed exactly in the manner of a privately owned line, and on that account has managed to show a very good profit so far. The action of the management in linking up their fleet with such firms as the Cunard Line, and Alfred Holt's, have shown a foresightedness and absence of the usual bureaucratic spirit associated with Government undertakings that gives the fleet a hope of success in the lean time to come. Canada has received a wonderful advertisement in all parts of the world through this excellent fleet, and it would have been well worth while from that viewpoint alone. Apart from this the fleet has opened up trade routes for Canada, and we believe has opened up the possibilities of export trade to many who had not previously given it a thought. The fleet is pretty nearly completely manned by Canadians, and is about as thoroughly Canadian an institution as can be found in the country.

The not inconsiderable lake and river traffic carried on by the Canadian Lake transportation companies has been bigger than ever this year, and it is pleasing to note that a purely lake steamer was launched for a Canadian company from the yard at Midland during the early part of December. This is a business which Canadian lake yards are as well able to handle as any others, and they should find much profitable work of this kind in the future. The repair business is well catered for in Canada, with dry docks at Sydney, Halifax, on the St. Lawrence, at Port Arthur, Collingwood and Midland on the Great Lakes, and in the near future on the Canadian Pacific coast.

Engineering Development

It is interesting to look over the development that has taken place during the year in the engine equipment of the new vessels built. While not wishing to take the attitude of "I told you so," it is pleasing to note that the prophecy we made as to the adoption of the oil engine is coming true. There is a gradually increasing number of shipowners adopting this type of motor, and it is not in small ships by any means that it is being adopted. It is pleasing to note in this connection that the large engineering firms in Great Britain are keeping well ahead in the internal combustion engine field, and have produced several interesting designs which have proved very successful. The companies which have adopted the internal combustion engine for their ships include such well-known names as Elder, Dempster & Co., T. & J. Brocklebank and the Glen Line of Glasgow. The number of vessels fitted with internal combustion engines now represents near 2% of the number in Lloyd's Register. Those burning oil fuel under boilers number 16.3%, while 76% use coal. The remainder are sailing vessels. There is little likelihood of the spread of the use of oil fuel to raise steam, as the price of oil is getting prohibitive for that purpose. It is not in the interests of conservation that oil should be largely used in this manner, as there is a large loss attending it. A good many vessels are fitted to burn either oil or coal under their boilers, and can change over from one to the other with little trouble, thus enabling them either to oil or coal their bunkers whichever is handiest, or cheapest.

The Geared Turbine in Favor

The geared turbine is also meeting with a large measure of favor, no less than 245 vessels of 1,286,046 tons being fitted with this class of machinery during the year. The reciprocating engine is still being put in a large number of ships, and there is no doubt that it will be in use for many years yet. Its record of reliability is something that will make many people cling to it till the newer forms have something of a record to show that can compare with the old three-legged job. The United States has experimented with ships fitted with the turbo-electric drive and have been sufficiently pleased with the results to decide on equipping a number of ships with this class of drive. It does not seem to have met with any favor in England or on the Continent. There seems to be a doubt if the extra weight and expense together with the complicated wiring, are justified in the ordinary cargo vessel.

There are, of course, certain advantages associated with the electric drive, notably in manoeuvring and in variable speeds, but for a cargo vessel these do not amount to much. The oil engine has developed to a point where it can be handled in manoeuvring as smartly as the triple expansion reciprocating, and nothing could be much handier than that. We do not anticipate the adoption of the electric drive in other countries than the United States.

There would seem to be little doubt but that shipping is in for a period of low

freights and hard times, and this will continue till the world settles down, if such a desirable consummation ever takes place. In circumstances like these, the only chance of survival is by practising the very bed rock of economy in the running of ships.

This means keeping personnel down to the minimum, quick turn round in every port, and the minimum of lost time for any cause. We believe the ship with oil engines will be far ahead of any of her rivals in this matter, but the number of them at present is so small that their effect on the general situation is small.

However they are incrceasing in a very steady manner, and in the next ten years it would not be a matter of surprise to see the major portion of the carrying fleet fitted in this manner. The next twelve months should bring some interesting developments in connection with the United States merchant fleet, which must be put on a commercial basis or go out of business. Just what method will be finally adopted to keep it afloat is hard to say, but we venture the opinion that enforcing the provisions of the Jones Act will do more harm to the new fleet than anything else that could be done.

The trouble is that the U. S. ship is costly to run, more so than any other nation ships, and there is no politician in the States with nerve enough to try and repeal the LaFollette Act. Even if there were, and he were successful, it is questionable if the ships could be manned with the special inducements removed. As it is, sailoring in United States ships is so desirable that numbers of men desert in U.S. ports from other country ships to get in on the good thing. There is no reason in the world why the United States should not have a merchant fleet, if sufficient people are interested in it, but to try and create a merchant fleet by eliminating the ships of all other nations from their ports, is to say the least a mistaken idea. The practice of withdrawing tonnage for a time, and then throwing it on the market in an effort to wipe out competition has also resulted in wiping out American companies which was not quite within the intention of the gentlemen who were doing the manipulating.

France has been handicapped in her shipping activities to a great extent by the coal strike in England. A large number of the French vessels were of the small collier type, expressly for carrying coal from South Wales to French ports. Naturally they have not been able to do much in this line. The large French transatlantic line is well under way again, after the cessation of the war. Italy has added considerably to her fleet, and has resumed all the services which she used to carry on. The Italians are experienced shipowners, and were possessed of some fine vessels before the war, and were among the heavy sufferers by the war. Japan has considerably increased her tonnage, but things are not too rosy in shipping circles in Nippon just now. Germany and Austria are of course still out of the reckoning as far as merchant shipping is concerned, although the arrangement made with the company of which Mr. Harriman is in control, points to the fact that the Hamburg-American line is not going to frozen out if they can help it.

This is not a time for prophesying, but more for hoping, and the hope is that the turmoil in Russia and other European countries will subside ere long and active trading commence between the various parts of the world. Only in that way will there be cargoes for the ships of all nations, work for the people of all nations, and an equitable exchange rate which will once more put commodities in the reach of people of moderate means. In short, a return to the normal is what we hope, but with a higher standard of living than obtained before the war. This is quite within reach, once the peoples of the different countries settle down to working instead of fighting. Let it be soon.



LAUNCHING A CANADIAN GOVERNMENT STEAMER AT COLLINGWOOD—THE "CANADIAN ROVER."

REDUCING CORROSION

According to D. M. Buck, metallurgical engineer for the American Sheet & Tin Plate Co., Pittsburgh, there is an overwhelming mass of evidence to prove that by allowing with normal open-hearth or Bessemer steel a small copper content—0.15 to 0.25 per cent.—the corrosion produced by air and moisture is greatly reduced. The melting point of copper is about 700 deg. Fah. lower than the average tapping temperature, it diffuses readily, and once diffused does not segregate.

The manufacture of copper steel has heretofore been largely confined to sheet metal, and the product has been greatly improved. A conservative estimate indicates that the life of sheet metal is at least doubled by this treatment, and in speaking of this subject he advocated the use of copper in all iron and steel products called upon to resist the attack of air and moisture.

It was stated at a symposium on refractories for electric furnaces held by the Electric Furnace Association, of Columbus, U. S. A., that refining furnaces, handling metal and corrosive slag at temperatures limited only by the melting point of the furnace itself, have about reached the limit of their possible development. It would appear that a new, cheap, dependable refractory with a melting point higher than 1750 deg. Cent. is now required, a substance which is highly resistant to sudden temperature variation so as to permit intermittent operation, which has been calcined at electric furnace temperature, and which, therefore, possesses reasonable constancy of volume. It must resist the scour of slag—or if a roof brick, must withstand the action of fume, hot gases, and splatters of liquid. It must be a poor conductor of electricity, or leakage of current may be serious. Finally, it must have sufficient strength at high temperatures to meet the requirements for the arches and side walls of the furnace.

A proposal is being considered, says the Engineer, to preserve the French supply of gun-cotton and nitrocellulose explosives — about 90,000 tons — by placing it in tanks at the bottom of a lake in the Pyrenees. Stored away at a safe and constant temperature, it is believed that the material would neither deteriorate nor decompose.



WELDING AND CUTTING



The Welding of Locomotive Fire Boxes

Welding Door and Flue Sheets, Patches on Firebox Sheets, Patches on Mudring, Door Collars, Knuckle Cracks, Building Up Worn Edges of Fire Box.

IN December 16th issue of Canadian Machinery we commenced this article by telling how full welded fireboxes, semi-welded fireboxes, and full welded, half side sheets were prepared and completed. In this the concluding portion of the article, we will touch on the subjects mentioned in the heading.

Welding Full-Welded Door and Flue Sheets

The method to be followed in preparing to weld door and flue sheets is similar to that described for full-welded fireboxes, as shown in Fig. 25. In the full-welding of door and flue sheets, however, the work is done on the inside at all the joints except the one with the crown sheet. That part of the welding is to be done on the water side, unless the radial staybolts are in the door sheet, when the welding must be completed from the inside.

First fit and bolt the door or flue sheet to the mudring. Next bevel both edges of the vertical joints on the inside, leaving a 3-16 in. opening at the bottom of the vee, see Fig. 26. Now bevel the joint with the crown sheet on the outside. The door and flue sheets should be flanged, as shown in Figs. 27, 28 and 29.

Tack weld the joint for an inch at R1, Fig. 25. Then drop down about 10 inches and weld from R2 up to R1, from R3 to R2, so continuing to R5 and welding last at A on the mudring.

Assuming that the radial staybolts are not in the door sheet, both the door sheet and the flue sheet should be welded on the water side to the crown sheet, starting at c, about 10 inches from R1, Fig. 25, and welding back to R1, from d to c, e to d, on over to L1 and then welding on the inside of the firebox from L2 up to L1, thus welding along until the sheet is finally completed at B on the mudring.

Welding Patches on Firebox Sheets

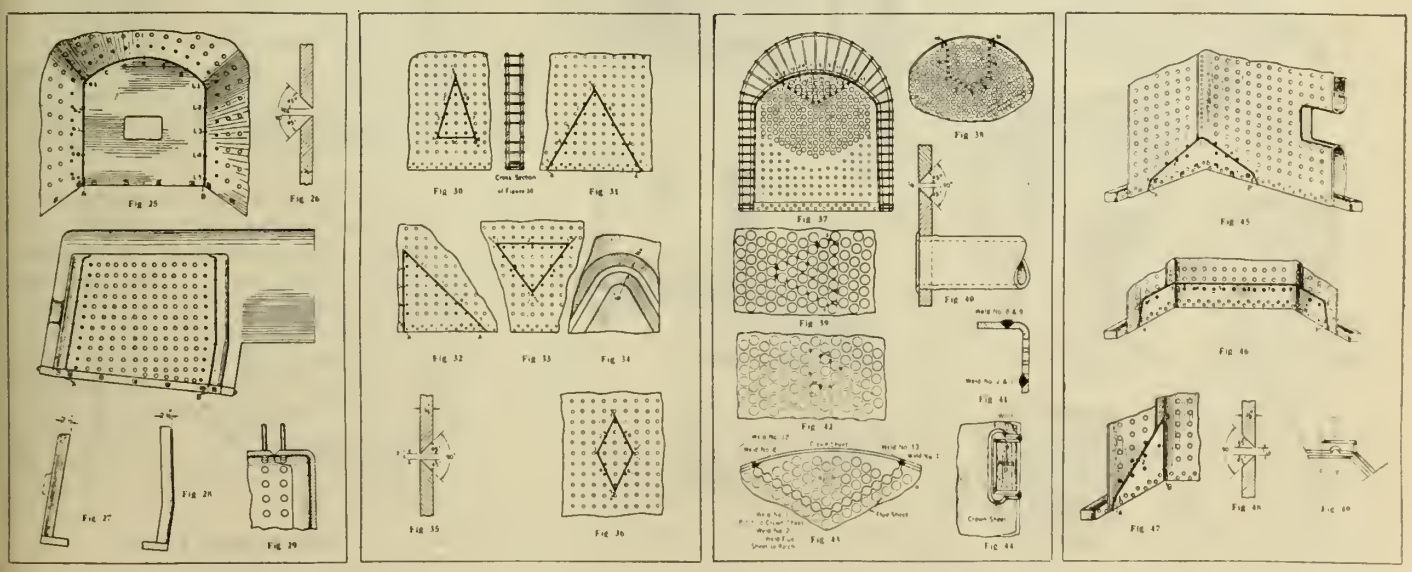
Patches for Firebox Sheets should be triangular in shape whenever possible, the reason being that the sides of the triangular patch do not run parallel with the rows of holes, and weaken the joint, as would a rectangular patch.

To weld the patch shown at Fig. 30, proceed as follows: Bevel the edges, then tack weld at 1. Then, beginning about 10 inches from 1 at 2, weld up to 1, from 3 to 2, and from 4 to 3. Let the joint become cold. Then weld from 5 to 4, and 6 to 5.

Preheat as shown at xxx1, to allow for expansion. Weld from 8 to 1, 7 to 8, and 6 to 7, and complete the job by preheating at xxx6.

To weld the patches shown at Figures 31 and 32, first bolt the plate to the mudring. After bevelling the edges, tack weld at 1. Then weld from 2 to 1, 3 to 2 on down to the mudring at 5. A, should be done last. When the weld is cold, preheat at xxx1, and weld from 6 to 1, 7 to 6 on down to the mudring at A.

In welding the patch shown at Fig. 33, proceed as follows: Preheat along xxx1. Then tack at 1 and weld over about 10 inches from 2 to 1 and 3 to 2. Let the plate get cold. Preheat again at xxx1 and weld from 4 to 1. Then preheat at xxx5 and weld from 5 to 4. Let the



THIS VIEW TAKES IN FIGS. 25 TO FIG. 49.

sheet get cold. Preheat at xxx3 and weld from 6 to 3. Again preheat at xxx5 and weld from 5 to 6.

Figure 34 shows the proper way to round the corners of the patches, using a radius of about ¾ in. In preparing all of the joints, use a bevel of about 45° and leave the vee open about 3-16 in. at the bottom, as shown in Figure 35. In using the diamond patch at Figure 36, the welding should be done in the same way as that described for the triangular patches. Expansion must be provided for by the proper preheating and reheating at the ends of the line of weld.

Welding Patches on Flue Sheets

The triangular shaped patch should be used for flue sheets wherever practicable. The method of applying the patches may be described as follows, the welding being done on the water side of the firebox:

Welding on Patch of Figure 37

First cut the flue sheet as shown in the drawing. Next weld the bridges at 1, Figure 37. Then weld from 2 back to 1 and from 3 to 1.

Weld the knuckle at 6 and then from 10 to 6. Then weld the knuckle at 7 and from 11 to 7. Complete the job by welding to the flange at 12 and 13.

The next patch, Figure 38, is for a deep job and requires less welding to the flange. In this case prepare the sheet as described for Figure 37. Weld the bridges at 1 and from 2 to 1. Then weld from 3 to 1, 4 to 2, 5 to 3 and so on until knuckles are welded at 8 and 9. Next weld the patch to the flange at 10 and 11.

To weld patch Figure 39, proceed as follows: Weld successively bridges 1, 2, 3, 4, 5, and 6. Preheat at ends of rows, and weld bridges 7, 8, 9 and so on until all are welded. All welds should be butt-jointed as shown in Figure 40.

To weld cracked bridges such as shown at Figure 42, first preheat bridges marked x at 1 and 2, then weld at these points, and reheat at x.

Welding Patches of Figures 43 and 44

First weld patch to crown sheet. Then weld flue sheet to patch as shown at 2 and 3 of Figure 41. Next weld flue sheet to crown sheet at 6 and 7 (see Fig. 43), using butt joint 8 and 9, Figure 41. Now weld to the flange at 12 and 13. A patch may now be welded to the crown sheet as shown in Figure 44.

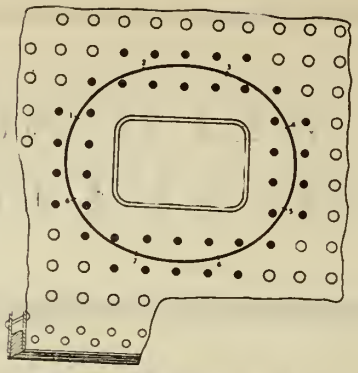


Fig. 50

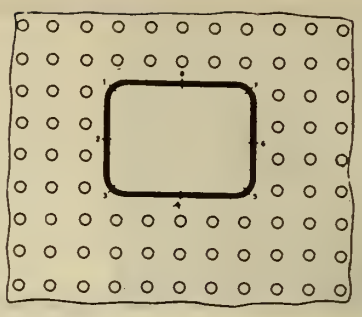


Fig. 53

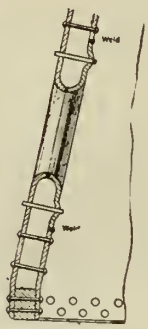


Fig. 51

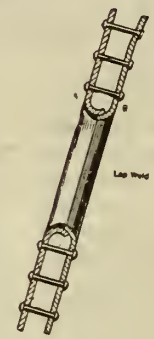
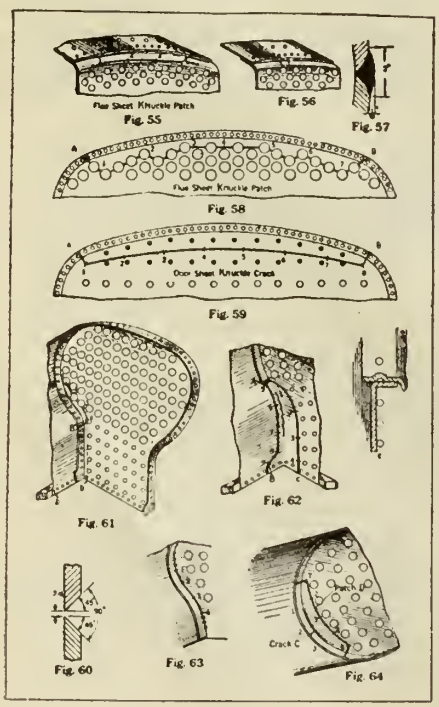


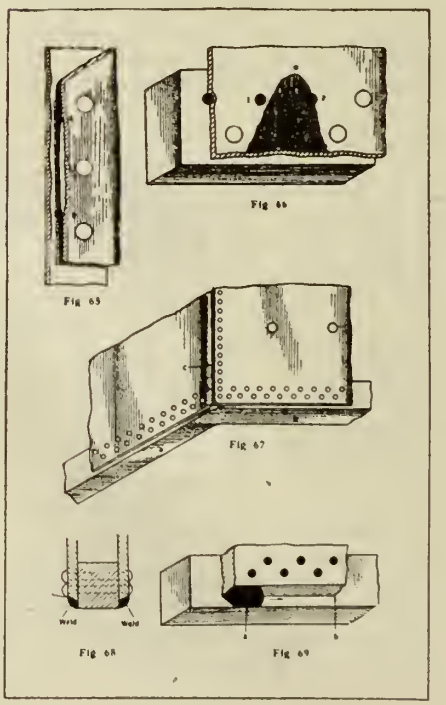
Fig. 54



Fig. 52

FIGS. 50 TO 54 INCLUSIVE.





FIGS. 55 TO 69—SEE TEXT FOR DESCRIPTION

Welding Patches on Mudring

The following three methods of patching mudrings have proved to be most serviceable. Make sure that all rivets are left out adjacent to the weld. To weld the patch at Figure 45, proceed as follows: Weld from A to 1. Then weld from 2 to 1, and from 3 to 2. Next weld patch to flange at 3, Figure 45, as shown in detail at c and d, Figure 49. Then weld from 4 to 3 and on to B.

To weld patch shown at Figure 46, first weld from A to 1 on the mudring. Then back weld from 2 to 1, and allow weld to cool before welding from 3 to 2 and so along to 10. Complete the weld at B.

To weld on patch shown at Figure 47, proceed as follows: Remove the rivets adjacent to the weld on the mudring and side sheets, also remove the staybolts that would be affected by the heat. Start to weld at A. Then weld from 2 to 1, a distance of about 10 inches apart, and let the metal cool. Weld from 3 to 2, also welding to flange near 3. Then from 4 to 3 and B last. All weld joints should be beveled at 45 degrees and opened 3-16 in. at the bottom, as shown in Figure 48.

Welding Door Collars

In welding locomotive door collars the door sheet should be made large enough

to include a row of staybolts within its area, as shown in Figure 50. First bolt the patch in place by screwing in some of the staybolts, then bevel the edges of the weld joint at 45 degrees on the inside of the firebox.

Next tack weld for about an inch at 1 and 5, Figure 50. Now advance about 10 inches to 2 and back weld to 1. Weld from 3 to 2, 4 to 3 and 5 to 4. Next weld from 8 to 1, 7 to 8, 6 to 7 and 5 to 6. Figure 51 gives an end sectional view of the welded joint of a door collar.

Welding Door Holes

In welding door holes for locomotive fireboxes the butt weld of Figure 52 should be used. The work should be done as follows: Bevel the edges to 45 degrees and leave bottom of weld open about 3-16 inch. Next tack at 1, Figure 53; weld from 2 to 1, 3 to 2 and so on to 5. Then weld from 8 to 1, 7 to 8, 6 to 7 and 5 to 6. A lap weld like that of Figure 54 is sometimes used for welding door holes, but it should not be resorted to if the butt weld of Figure 52 can be made.

Welding of Knuckle Cracks and Patches in Door and Flue Sheets

In the following work the welding should be done on the water side of the firebox wherever possible. To weld the flue sheet knuckle crack of Figure 55, proceed as follows:

Preheat at xxx1, and tack weld at 1. Then start at 2 and back weld to 1, from 3 to 2, and 4 to 3. Reheat at xxx4.

In welding the flue sheet knuckle crack of Figure 56, first weld from flue sheet over knuckle to crown sheet on the water side of the firebox, and complete weld from the inside. This weld should be reinforced about 1-8 in. and widened to about 2 inches at the top of the vee, as shown in Figure 57.

To weld the flue sheet knuckle crack of Figure 58, first start to weld the flange at A, Figure 58, working on the inside of the firebox. Then weld on the water side from 1 to A, back weld from 2 to 1, 3 to 2 and so on to the flange at B.

In welding the door sheet knuckle crack of Figure 59, commence working from inside of firebox, and weld from 1 to A, back weld from 2 to 1, 3 to 2 and on across to 8 and B. The distance between tack points of weld should be about 10 inches. Figure 60 gives the form of vee for the butt weld. In welding the flue sheet patch of Figure 61, first weld the flange at A. Then back weld from 2 to 1, and on to B.

When welding a flue and side sheet patch such as shown at Figure 62, first cut the side sheet to outside of the rivet holes, as shown in drawing c. Weld the flange at A, and then back weld down to the flange at C. Now weld from 6 to 5, 7 to 6 and so on to B.

The flue sheet weld of Figure 63 should be performed as described for Figure 55, and the crack C of Figure 64 should be welded the same as that of Figure 55, while patch D may be welded in place by the method shown in Figure 61.

Building-up Worn Edges of Firebox

The edges of fireboxes become worn, and cause leaky joints, from excessive caulking, erosion from escaping steam and corrosion. The restoration of these edges by building-up may be accomplished as follows:

First refer to Figure 65. Brush the rust off the edge and build up from 1 to 2. Light hammering of the weld while red hot will improve the joint. At Figure 66, a piece rusted out as shown in this figure may be built up by first removing the rivets 1, 2 and 3, and then adding metal from A down to the bottom of the sheet to the mudring. The last example, Figure 67, is somewhat different. In welding sheets to a mudring build up the joint of the two sheets for about 5 inches above the bottom. Bevel the bottom of the sheets as shown in figures 68 and 69.

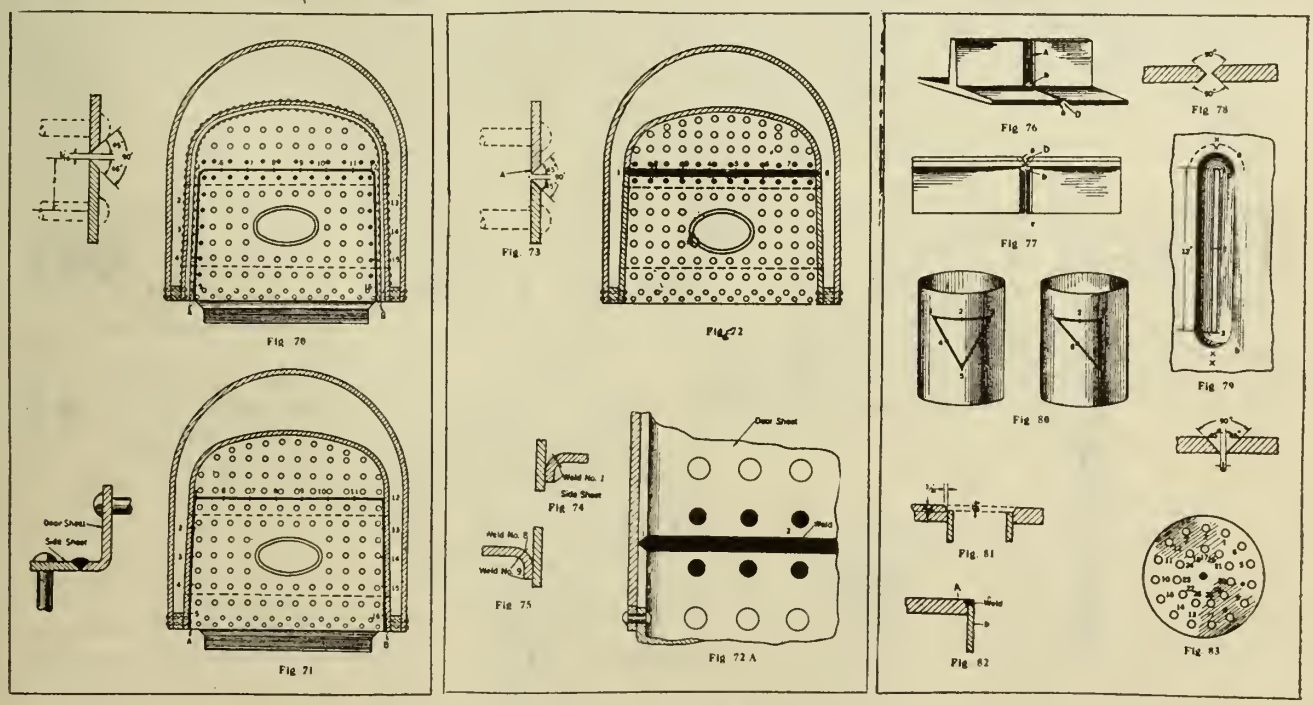
Welding Full-Welded Half Door Sheets

There are two methods used to weld in half door sheets of fireboxes. That shown in Figure 70 is sometimes resorted to to save time. It is not the best way to do the work, however. This method leaves the old riveted flange on the side sheets. The welding is done by starting at 1, back welding from 2 up to 1, and so on around, ending at B on the mudring. The most serviceable way to do the work is as shown in Figure 71.

The side sheet should be cut to the inner edge of the rivet holes, fitting the door sheet to the edge of the side sheet, and bevel the joints as shown in sketch at left of Figure 70.

Screw in the second row of staybolt holes, and bolt the door sheet to the mudring. Using a suitable tip and welding blowpipe with correct welding rod, start to weld at 1, Figure 71. Then weld the door sheet to the side sheet by welding from a point about 10 inches down at 2 up to 1, and from 3 to 2 and ending at A on the mudring. Back weld 10 inches from 6 to 1, from 7 to 6 and on around to B at the mudring. The sketch at the left of Figure 71 shows the style of joint between the door sheet and the side sheet.

Continued on Page 633



FIGS. 70 TO 83.—THIS CONCLUDES THE SKETCHES.



WHAT OUR READERS THINK AND DO



REDESIGNING SINGLE PURPOSE MACHINES

By G. Barrett

During the past two years we have heard a lot of talk regarding increased production, but are manufacturers taking the same interest in the development of jigs and fixtures that they did during the war period? There are a lot of old machines around the country at the present time that could be redesigned or modified for useful work. The accompanying sketch shows a special grinder constructed from an old single purpose shell machine. The headstock of this machine was removed and a knee bracket A bolted to the bed with the headstock on top. The vertical face of the knee bracket is provided with a dovetail slide to carry the movable tab' B, which carries the compound rest C and D, the latter being operated by means of a rack and pinion. Fixtures of different design may be used for a variety of work.

The sketch shows the machine adopted for the grinding of pulleys. The jig consists of a cast iron block E, shaped at an angle of 2 degrees, with a stud set in at right angles to the inclined face. The stud F is fitted with ball bearings to facilitate revolving when grinding. A cup wheel G is used and numerous sizes of pulleys can be economically produced in this way.

In some instances it might be advisable to finish turn after grinding. This could be accomplished by form turning, as shown in Fig. 2, where two or more pulleys are located on the one arbor and turned at the same time.

Sketch Fig. 3 shows a speed cone bracket used on a drill press. These brackets were originally planed, which proved both long and expensive. The fixture for holding these brackets while grinding is shown in Fig. 3, and is simple and costs little to make when compared to the production of brackets, which is about six per hour. A similar fixture is used for grinding the base of the pump bearing shown in Fig. 4. The piece is held to the locating pin, insuring the base being square with the bearing. Fig. 5 shows a fixture for the grinding of the yokes for clutches. This is made of cast iron with a V-block to support the lug on the yoke. Two small pins are provided to keep the face of the yoke in alignment with the wheel. These are only a few of many jobs that could be economically performed on a machine of this description, and it would be well for many firms to give a little attention to machines that have probably been relegated to the scrap heap, the remodeling of which would undoubtedly prove a profitable undertaking.

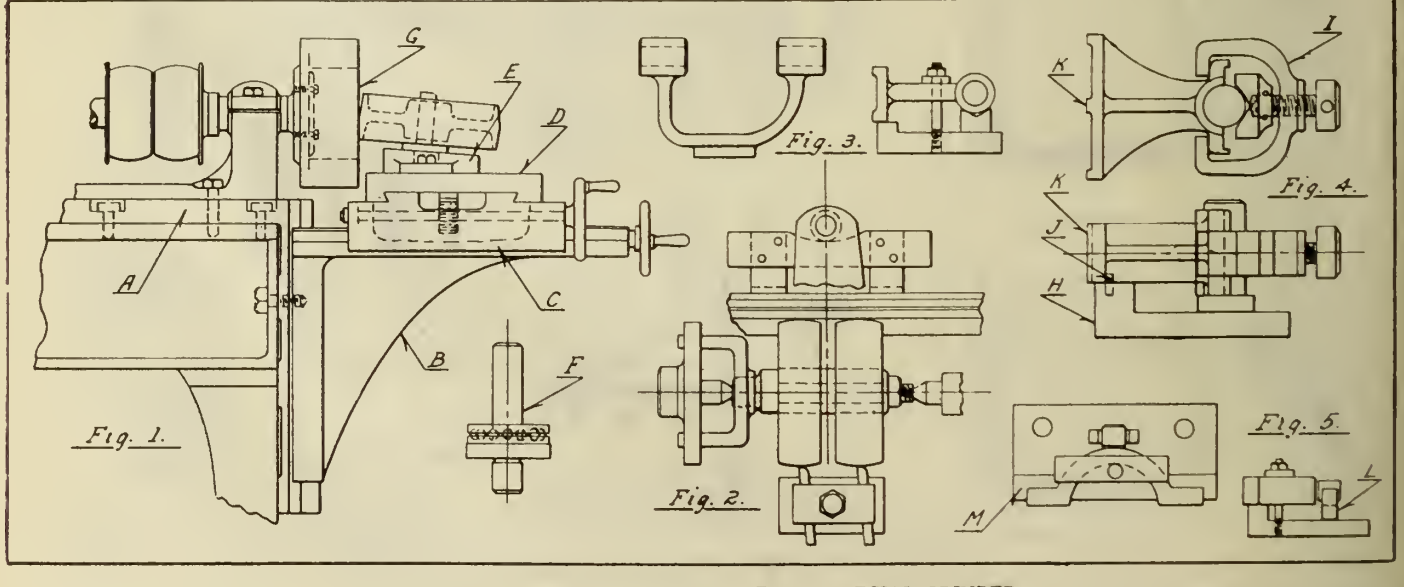
Editor's Note.—We believe this article raises a point of real merit, namely the possibility of modifying war time special machinery for peace time products. No doubt many readers have seen various installations of such nature, and we would welcome sketches and descriptions of the same.

STEEL CUTTING EDGES

By W. S. Standiford

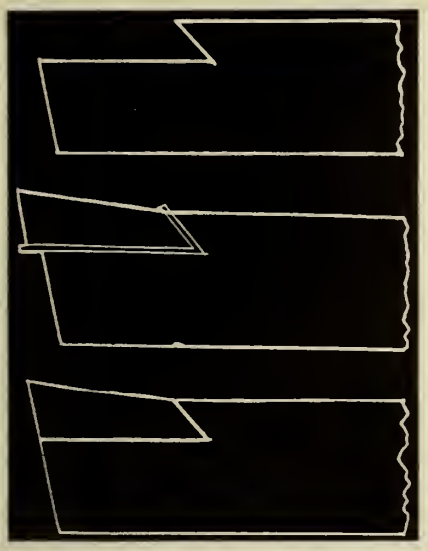
Probably one of the most useful and money saving metals that the machinery manufacturer reecives the greatest benefits from is high-speed steel. By having the tools for production work made out of this material a greater output has been secured at a lower cost per piece, in spite of the fact that this grade of steel is a very high priced one. The fine qualities of high speed steel are getting to be more generally known among the rank and file of business men, and in the last few years its price has risen to such an extent that it has become a matter of great importance to make a pound of steel produce as many tools as possible.

To use a solid tool made of high priced steel is very expensive, and in cases of this kind great satisfaction can be obtained by having a blacksmith forge a shank of ordinary machine steel, and weld or braze a small piece of the high speed metal on top of the shank to be used as a cutting tip. The great drawback to either welding or brazing work of this character, exists in the fact that it is a very difficult matter to secure a perfect union between the relatively soft



FIGS. 1 TO 5. SHOWING DETAILS OF THE SPECIAL GRINDER.

machine steel shank and piece of the high-speed metal so that it will withstand the heaviest roughing cuts that the machinery will allow. This is a necessity, as the greatest speed in doing work is obtained by cutting the roughing time down to its lowest possible limits; the production costs also being reduced by



HOW THE CUTTING EDGE IS PREPARED.

this method. By following the method outlined below, it will be found feasible to make a perfect union between the soft steel shank and the hard steel cutting tip that will give good satisfaction to the user of tool.

First forge the shank to its proper size and shape, and cut a slot in its top as shown in Fig. 1 of sufficient size as will allow of the insertion of a small piece of the extra hard metal to occupy this space, having the piece project out about 3-16 inch from the front and also 1-16 inch out from the sides of shank in order to allow for grinding after it is finished. It is also a good plan when making the shank to taper both front and sides at their bottoms. This facilitates quick grinding of the tool after hardening as a much smaller amount of metal has to be removed. The back end of both slot in shank and tool tip should be tapered to match. This makes it have a close contact when brazed and helps to keep the piece in position when a heavy strain is put on the front of the tool during the roughing cuts. Next cut a small piece of sheet copper about 1-32 inch thick to a slightly greater width and length than the bottom of slot that is shown in Fig. 1 and bend one end to fit the angle closely at the back of bar.

Brighten both the slot in tool shank and also copper strip with emery cloth or paper and treat the tip that is to be inserted the same way. Then coat both copper strip and the slot in machine steel bar with borax. Place tip over the copper piece and tie it tightly with wire so as to hold it in place during the heating operation. Fig. 2 depicts the tip placed over the sheet copper strip, no binding wires being shown in the picture. The tool is now put into a heating furnace and heated to the proper temperature recommended by the makers of the steel. When this is effected, remove tool and with quick blows of a hammer used on front of tip, drive the beveled part of tip into its seat, then quickly strike the high-speed steel piece a couple of moderately heavy blows. This distributes the melted copper and borax uniformly over the joint and at the same time causes the two metals to unite. Quickly plunge tool into the quenching bath and keep it moving until it is cold. Grind it to shape and it is ready for use in the lathe or planer. The combination of a machine steel shank with a piece of extra high grade and priced steel, produces a cheap, but efficient tool that will give good service if the brazing has been very carefully done. It is possible by this method to successfully unite various brands of high speed steels to machine steel shanks, although the writer has not tried whether "stellite" (which is said to contain no steel whatever) could be welded or brazed to shanks of a cheaper metal.

A NEAT REPAIR

By Tyke

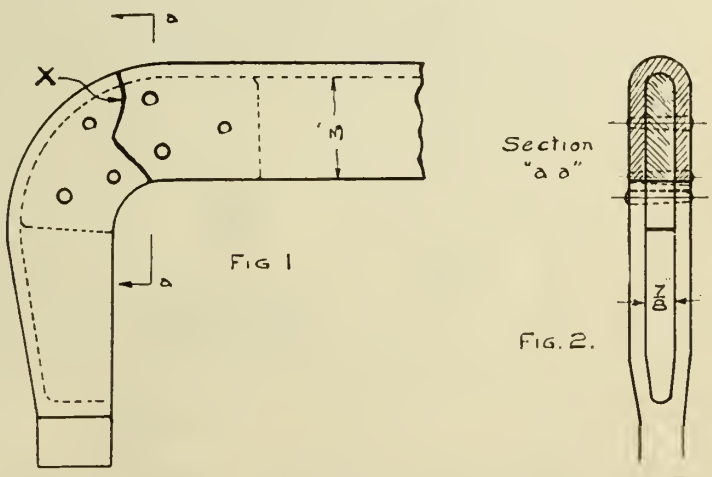
Some time ago the frame of a heavy duty power hack saw was broken at point "X" Fig. 1, due to an accidental obstruction of the stroke. The frame was of cast iron, and inverted U section. Due to this peculiar section and the small dimension between the inside of the U, it is doubtful if a really good welding job could have been made. In any case, it was decided to make a purely mechanical repair and the interesting part is that neither bolts nor rivets were used.

A forging of the proper shape and thickness was quickly made and simply ground on the high spots so that it could be tapped lightly into place, though no pretence at fitting was made. When the two pieces of the frame butted closely together, the frame and forging were clamped and drilled, then reamed for No. 8 taper pins which are approximately 1-2-in. diameter.

It will be noticed that these pins were not driven in from the same side, but were alternated, see Fig. 2. Furthermore, the holes were slightly eased in order to give the pins proper key draft and ensure proportional stresses on the pins. This precaution proved to be a wise one, as the draft not only ensured the broken ends of the frame butting properly, but increased the holding properties of the pins themselves.

After the pins were driven home, babbit metal was run into the frame about the forged piece in order to fill up any spaces that might exist due to any inequality of forging or casting. When cool, the pins were again lightly tapped to make sure they were tight and the frame assembled.

After many months' night and day work, the frame was carefully examined and the break was hardly perceptible and certainly no more so than the day it was repaired.



THE SKETCH ILLUSTRATES HOW THE REPAIR WAS MADE.

TRANSFERRING HOLES

By Harry Moore

Transferring of holes in various classes of work is of such common occurrence in the life of the average mechanic that a brief description of several well tried methods would probably be appreciated by many readers. The use of the dividers, square and other tools, in the laying off of holes, does not always give the best results, as the chances of error are so numerous that it is frequently impossible to maintain the accuracy required. It is, of course, in the repair shop that these operations are mostly met with; new parts being fitted to old ones, old parts being replaced, etc. Fig. A shows a new shaft being fitted to an old collar, the latter containing the holes previously used. This looks like a very simple job, yet if the hole is drilled out of line with that already in the collar, the insertion of the pin becomes a neat little operation of banging it around several corners until it finally peeps through the other side—a sorry looking pin, indeed.

A good way to avoid all this is to provide a V-block with a hole drilled through the center. It is then a simple matter to turn a piece of stock on the end to fit the hole in the collar and insert this in the hole drilled in the V-block. It will then be obvious that the collar and the shaft will be lined up properly and the drilling of the hole in the shaft will be done with a great degree of accuracy. A reverse condition to that just cited is shown at B, where the new collar requires drilling to fit the hole in the old shaft. The shaft, with the collar on the end, is placed in the V-block and adjusted so that the drill will enter the hole freely. A small parallel is then clamped to the shaft, with its side touching the V-block and the end resting on the drill table. The sleeve is now pushed into position and the shaft clamped down, first noting that the parallel is touching both surfaces as before. In starting a drill on a convex surface it is well to bring the drill lightly to the work until it has sufficient depth to guide it.

A convenient center punch for transferring the centers of holes is shown at C. It is made in three pieces, the punch being made of tool steel. All moving parts are made a sliding fit and the outer ring knurled to facilitate handling. Two small screws serve to keep the part together when not in use.

It is often required to fit a new cover to an old flange, where the latter has blind tapped holes. A case of this kind is shown at D. The old cover not being at hand, the work was set up as shown, a V-block being clamped on end and the flange pushed up against it, then lined up until the drill enters one of the holes. The new cover is now placed on top, clamped, and the hole drilled, a pin pushed into the hole, and the others drilled in the same way.

At E is shown a set up for drilling the holes in the periphery of a collar. Both old and new pieces are bolted to the angle iron and the latter position on the table controlled by two parallels fastened to the table, at right angles. Lateral movement of the angle to obtain the correct position for the new holes is obtained by means of a small cylindrical piece turned to the diameter equalling the center distance of the two collars. This method of drilling holes to conform to others is practically that of jig drilling. One big advantage with this method is that any inaccuracy in the initial piece is duplicated in the new piece, thus assuring a better result than if uniformity had been adhered to. There are very few cases where holes cannot be transferred direct by adopting a few simple principles as here outlined.

The gauge shown at F is one that may be used to good advantage in the locating of a center between two parallel slots or the sides of work. In operation the end pieces are adjusted to fit the slots when the bushing will be automatically centered; a center punch turned to fit the bushing is used to make the center mark.

GENEVA MOVEMENT PROBLEM

By G. Barrett

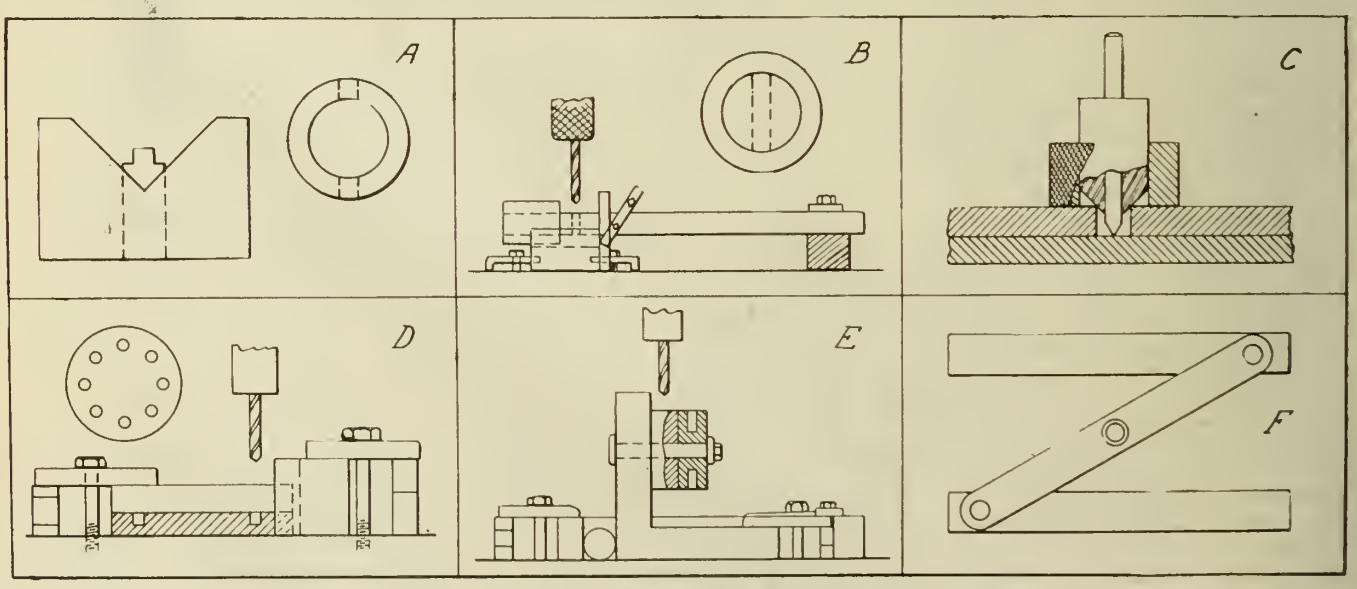
Relative to the Geneva movement problem appearing on page 398 of the October 28th issue, I submit the following as my method of manufacturing this piece. The material used would be cold rolled bar stock of the required diameter. The first operation would be performed in a small turret lathe, using two box tools, one for roughing and one for finishing the boss on the movement 19/64 inch in diameter, drilling the 7/32 inch hole in the center, and parting off to the desired thickness. The box tool, which is of the hollow mill design, is shown at A, Fig. 1. These tools would give good results provided ample chip clearance was allowed for. The output from this operation should be approximately 30 per hour, or about 2 cents apiece.

The next operation would be the milling of the slots. The jig or fixture for this work would be similar to that shown in Fig. 2, which is of simple design, made from machine steel and hardened. The upright portion is bored in the center to fit the boss of the movement which is held to the face by means of the clamp B. As the slot being milled is 7/64 inch wide, I would use a 3/32 inch saw cutter; this would leave a few thousandths for filing. This particular operation would constitute a milling of one of the slots in all of the pieces, and would cost about 40 cents per hundred.

The fixture used on the succeeding operation would be identical with that shown in Fig. 2, but would have a small locating block as indicated at C. This method would eliminate the necessity of having an indexing attachment on the jig, and would be far more accurate, as there would be no working parts to wear and produce errors. Completing this milling of the slots would approximate a cost of 1¼ cents per piece.

We now come to the stage where the 29/64 inch radius would be formed. This would be accomplished in a punch press using a punch and die similar to that shown in Fig. 3. The die is slotted at D to receive the boss of the movement, and also to receive the locating pins E and F. These pins would be placed to bring the movement in the proper position for punching. The punch is cut away in front so that the back portion will act as a guide before the punch part G comes in contact with the work. The cutting face of the punch is ground at an angle of about 8 degrees to provide for proper shear. The cost of this operation would be approximately 40 cents per hundred.

The final operation would be finish filing to gauge. The slots would be filed to fit on the steel projection H, Fig. 4.



SIX HANDY HINTS. READ THE TEXT WHICH EXPLAINS THE STEPS CLEARLY.

The final gauging would be done on the gauge Fig. 4, which is made of a flat piece of steel with a hardened and ground pin to fit the bore of the movement, and another piece I hardened and ground and located in the block at the required center distance from the center pin. This final fitting would also serve to check up all other operations. This concluding operation would be done at a cost of about 8 cents apiece.

DOUBLE PARTING TOOL

By Clyde D. Thorburn

Some time ago we illustrated a double parting tool for use in cutting piston rings from sleeve casting, and the illustration herewith is that of another double tool for the same purpose. This tool was designed so as to have a longer life and would always be standard width between cutters. It is ground only on top of cutting edge, its design allowing the necessary clearances required. Body of tool is made from mild steel forging shaped on all flat surfaces and two grooves sawn in head to receive the high speed circular cutters. The cutters are turned slightly concave to insure continuous clearance and bevel on cutting face to make a clean cut-off.

The top tool is turned ⅛ inch larger in diameter than bottom tool. This is to allow for sufficient strength of metal to hold on the lower ring when parting off upper ring. Six ⅜-inch holes are drilled through the cutters and hole to correspond through jaws being tapped through one side of jaw to take the retaining pin. This allows for the moving of cutters as they are ground back through wear. The tool can be used on the side head of a Bullard vertical or ordinary vertical boring mill. We are using it there and find it a distinct advantage over previous tools.

WELDING OF LOCOMOTIVE FIRE BOXES

Continued from Page 629

Welding Half Door Sheets Riveted to Side Sheets

In preparing to weld half door sheets above or below the doorhole, the sheet should be cut not nearer the doorhole than between the first and second rows of staybolts as shown in Figures 72 and 72A. All the staybolts, except those adjacent to the weld, may be screwed in place. The door sheet should be riveted to the side sheet and mudring before welding, and the weld vee should be formed as shown in Figure 73.

Next weld the flange at 1, Figures 72 and 74, then at a distance of about 10 inches from 1, back weld from 2 to 1, from 3 to 2 and continue to 8. Figure 75 gives details of the end of the weld.

Patches on Cylindrical Shells

Sketches A and B, Figure 80 show how patches should be applied to cylindrical shells and tanks. The base of the triangular patch should run with the circumference of the shell. A weld like that of sketch A should be started at 1, and go to 3, and be allowed to cool. Then from 3 to 5 and cool. Finally from 5 to 1. The weld of sketch B should be run from 1 to 3, and allowed to cool. Then from 3 to 5 and cool, and from 5 to 1.

Locomotive Flues

To weld locomotive flues, first countersink the fluehole about 3-16 in. deep, as shown in Figure 81. Extend the flue to within 1-8 in. of the outer surface of the sheet and 1-16 in. beyond the bottom of the countersinking. Leave out the copper ferrules, and expand the flues just enough to fill the flueholes. Start to weld at the bottom of the hole, and weld around to the top on one side, and then the same way on the other half. Weld the fillet flush with the inside of the flue and the face of the flue sheet. Figure 83 shows the order in which the flues should be welded so that unequal expansion may be allowed for. Weld the row of flues 1, 2, 3 and then 4, 5, 6, then 7, 8, 9 and so on to completion.

Johnny—"Mother, why did you marry my dad?"

Mother—"Johnny, I married your father because he once saved me from drowning."

Johnny—"I'll bet that's why he won't teach me how to swim."

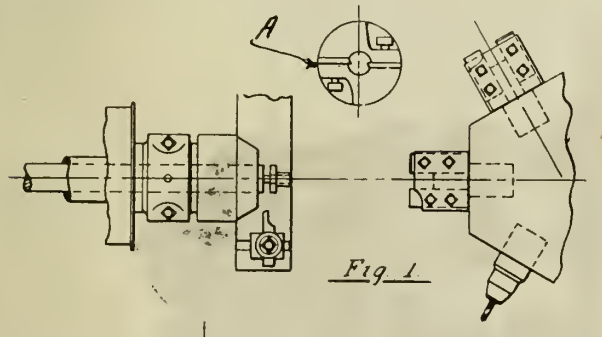


Fig. 1

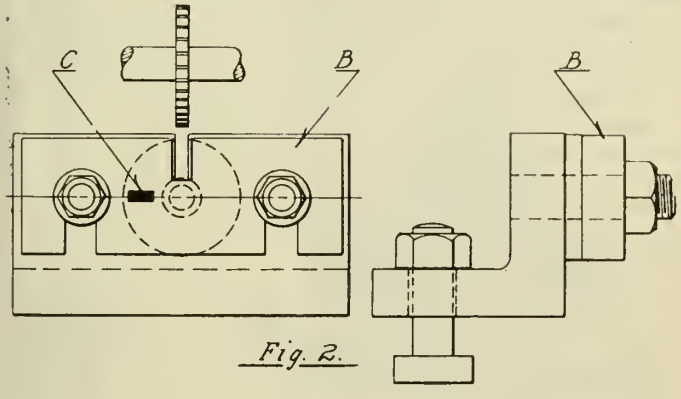


Fig. 2.

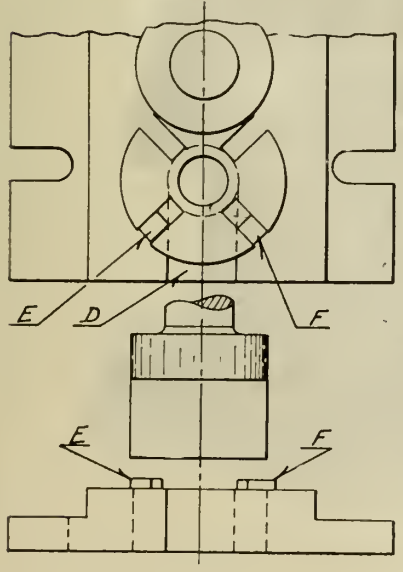
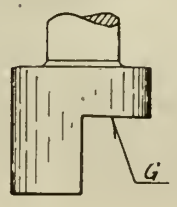


Fig. 3.



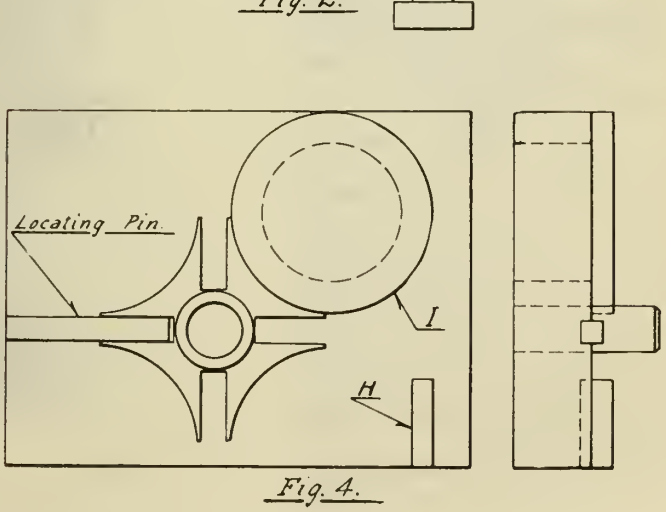
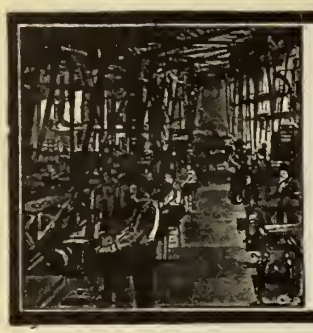


Fig. 4.

THIS IS HOW MR. BARRETT WOULD HANDLE THE JOB.



DEVELOPMENTS IN SHOP EQUIPMENT



NO. 4 PLAIN MILLING MACHINE

The Ford-Smith Machine Co., Ltd., Hamilton, Canada, have placed on the market a new machine to be known as their No. 4 plain milling machine.

This machine is of new design, and contains various features worthy of special attention. For example, special care has been given to centralized control of all movements of the knee and table, and rapid power is provided in all directions. This makes for speedy production, and the range and coarse feeds are said to be equal to those provided on geared millers.

Various Details

The column is of box section, with heavy wall and bars for supporting the knee and bearings. It is provided with door and shelves for holding necessary tools, etc. The spindle is a crucible steel forging, having a hole through its entire length. The front is threaded to receive a chuck or large cutter head, and this thread is protected by a cap when not in use. The front bearing is tapered, the back bearing parallel, the wear in the latter being adjusted by drawing up a bush which fits solidly into a tapered hole in the column.

The spindle is boxed for a B. & S. standard taper, and front of spindle is slotted, thus providing a positive solid drive. Each arbor support is provided with a wedge key, operated by a ball handle, this locking and locating the arbor support positively in line with the spindle.

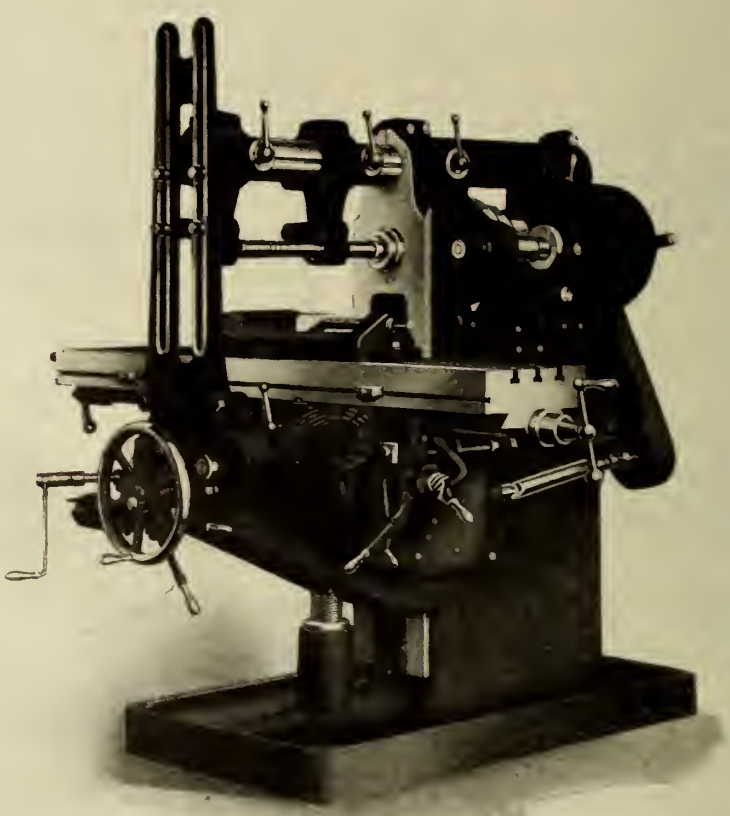
The knee is designed to give maximum rigidity under the bending and twisting stress of the cutter. It is a box casting of the solid top type, being well braced internally with short ribs. There are no holes in top or sides of knee. It is locked on the column by means of a handle located at the front of the knee. A narrow guide with an adjustable taper gib is provided for the saddle slide. The cross screw is located near the centre of the guide, thus giving easy motion to the saddle. The knee has power elevating feed through a telescopic screw with a ball thrust. This avoids the cutting of hole in floor to clear the screw. Graduated collars reading to one thousandth are provided on table, cross, and elevating screws.

The table is of very rugged construction with wide bearing and great depth. It is provided with oiling arrangements from the front, also felt wipers. The feed is autometic in both directions, and has a positive knock out.

The feed box is not carried on the column in the orthodox manner, but is bolted to an extension of the saddle on the knee. This new departure makes possible the arrangement of a dial feed hand wheel, handy to operator at working position in front of knee. Twelve changes of feed are obtained from the dial, which, in conjunction with the coarse feed handle at the front of column. gives twenty-four changes when the back gear is in.

All feed gears are hardened steel, ground in the bore. The feed shafts are also hardened and ground. A cone miller is often handicapped on large face milling work on account of the feed dropping in proportion to spindle speed, this, of course, causing lower production on work which must run at slow spindle speed. To overcome this trouble a feed change is provided next to the spindle. For ordinary work the feed is driven off the feed pinion keyed to the spindle, but when the back gears are engaged, the feed may be driven off the cone pinion which speeds up the whole feed mechanism 3 to 1, or 10.8 to 1, according to the ratio of back gear engaged, thus making possible the very coarse feeds provided. The range of feed is from .006″ per rev. of spindle, to 1.56″ per rev.

The feed reversing mechanism is carried in the feed box on the knee, giving a reverse to all feeds. The rapid power control levers have to be held in position by hand while the rapid power is engaged, making accidental or thoughtless operation impossible. Should the feed run over at any time, a safety trip device prevents any breakage or damage. This machine is said to be the only cone driven machine having rapid power to knee as an integral part of the design. The countershaft is of two-speed friction



GENERAL VIEW OF NO. 4 PLAIN MILLER.

type with self-oiling bearings. Friction clutches are of improved expanding type, carefully balanced, with means for taking up wear, Machine is, of course, supplied with all necessary wrenches, oil pot, cutter arbor, etc. Following are the principal specifications:

Table working surface, 71″ x 14½″; T. slots, three ¾″; Longitudinal traverse, 42″; Cross traverse, 12″; Vertical traverse, 20″; Face of column to brace, 30″; Dia. of spindle in front bearing, 3½″; Size taper hole (B & S), No. 11; Size hole through, 13/16″; Spindle speeds No., 18; Spindle speeds range, 14 to 415 R.P.M.; Overarm dia., 4¾″.

Distance centre of arbor to underside overarm, 7¼″; Large cone dia., 13″; Cone belt width, 3½″; Ratio back gear, 3 to 1, 10, 8, to 1; No. of feeds, 24 with back gear in, 12 without back gear in.

Range of feeds per rev. of spindle, .002 to .39″ cross and elevating, .006 to 1.56″ table screw; Rapid power traverse, 12″ per min. elevating, 32″ per min. cross, 130″ per min. table traverse; vise plain, 8½″ wide, 2¼″ deep, 7″ opening; Countershaft pulleys, 16″ dia., 5″ face; Countershaft speeds, 180 and 220 R.P.M.

BALL BEARING DRILLS

Output, convenience, durability. These are the features much to be desired in any machine tool. The Alfred Herbert, Limited, Coventry, England, claim all three for their varied line of ball bearing drill presses. The first of the photographs (see Fig. 1) depicts a form spindle machine with three plain and one geared spindle. All spindles have automatic, self engaging, self releasing feed mechanism. Fig. 2 shows a two spindle plain lever feed machine.

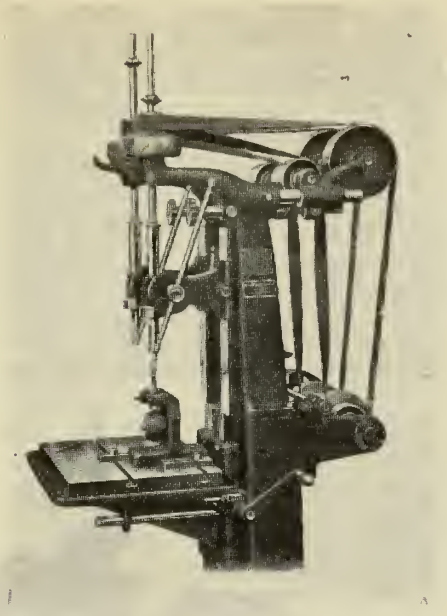


FIG. 2—TWO-SPINDLE PLAIN LEVER FEED MACHINE.

Every bearing in these machines is a ball bearing, and we illustrate a sectional view of the spindle showing the spindle pulley bearing see Fig. 3. The spindle bearing construction, is unique in design and is patented. The only running bearing on the spindle is the one near the bottom of the spindle which takes all journal load, and upward and downward thrust. The reason of the success of this bearing under combined journal load and thrust is that on a vertical drilling spindle the end thrust is always greatly in excess of the side pressure, thus insuring that the load is continuously and equally shared by all the balls, and no ball ever has to sustain more than a very small fraction of the whole load.

The spindle passes through the feed sleeve without touching it, and is provided with a dust cap. The illustration of the spindle pulley clearly shows how the upper end of the spindle passes through but does not touch a fixed bush, the outside of which carries the two annular ball bearings of the spindle pulley. The spindle is splined and is driven by a key and centralized by the part of the pulley which projects above the fixed bush. This construction has proved of high mechanical efficiency, avoids all necessity for "floating" drives or other devices for preventing the spindle from binding in its bearings, and is simple and free from the possibility of faulty adjustment. The spindle is balanced by a flat helical spring acting on the pinion shaft, which eliminates the more common chain and balance weight and works with much less friction.

The self engaging, self releasing, automatic feed feature is worthy of note as it is said to be a great aid to production. The operator merely pulls down the feed lever until the drill touches the works, upon which the machine automatically feeds the drill, stops feeding at the required point, and then instantly withdraws the drill. Three rates of feed are provided with the automatic feature.

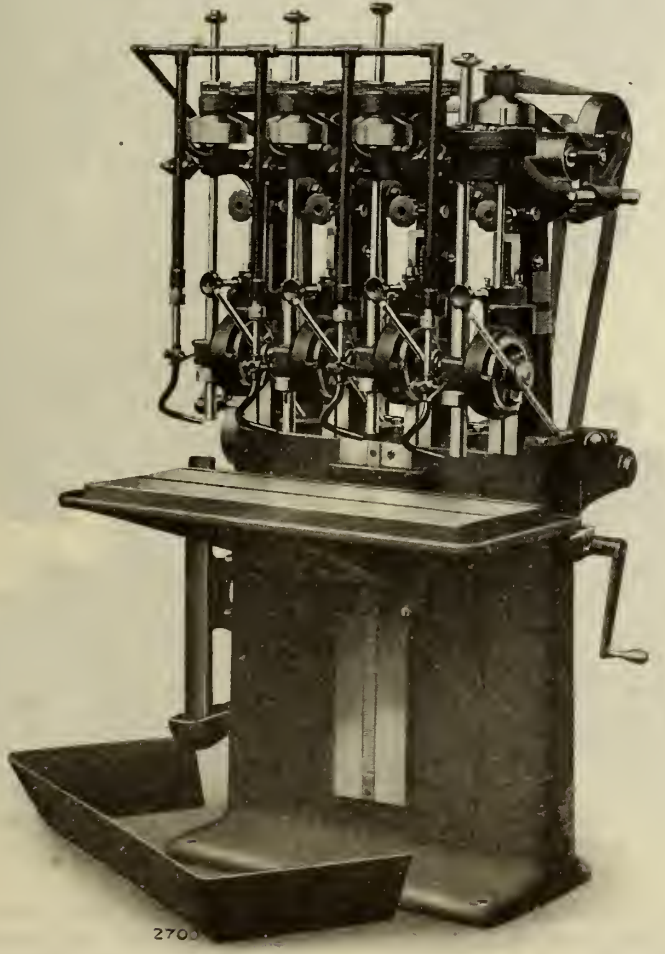


FIG. 1—FOUR-SPINDLE MACHINE WITH THREE PLAIN AND ONE GEARED SPINDLE.

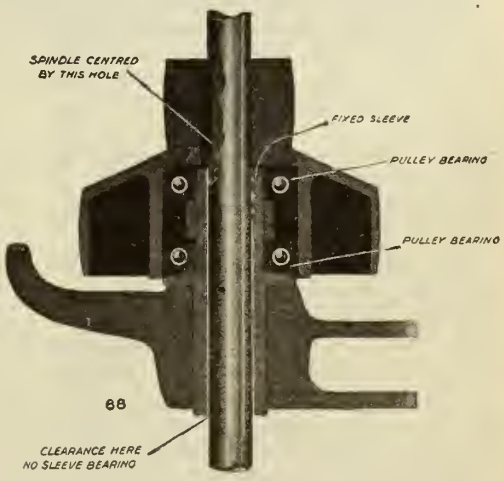


FIG. 3—DETAIL OF SPINDLE PULLEY BEARING.

Briefly, here are some other points of interest. These machines have a belt system by which six speeds to each spindle are obtained with the belt properly tracked for each speed, the convenience of the belt tensioning arrangement, the exceptional table area, the convenience of the two T slots in the tables, the con-

venience of the elevating and lowering motion to the table by rack and pinion. The general rigidity of the machine is worth notice, also the convenience of the pump and fitting arrangements, which have no easily choked flexible pipe connections.

These drilling machines are supplied in one to four spindles with any combination of spindles, i.e., with plain lever feed spindles, plain spindles with automatic feed, or geared spindles with automatic feeds. The maximum capacity in steel of the plain spindle is one inch, and of the geared spindle one and one-quarter inch. The range of six speeds on the plain spindle is 230, 530, 600, 900, 1,370, and 2,050 r.p.m., and on the geared spindle 77, 147, 170, 194, 321, and 424 r.p.m. This concern have their Canadian office and showroom at 1-3 Jarvis Street, Toronto.

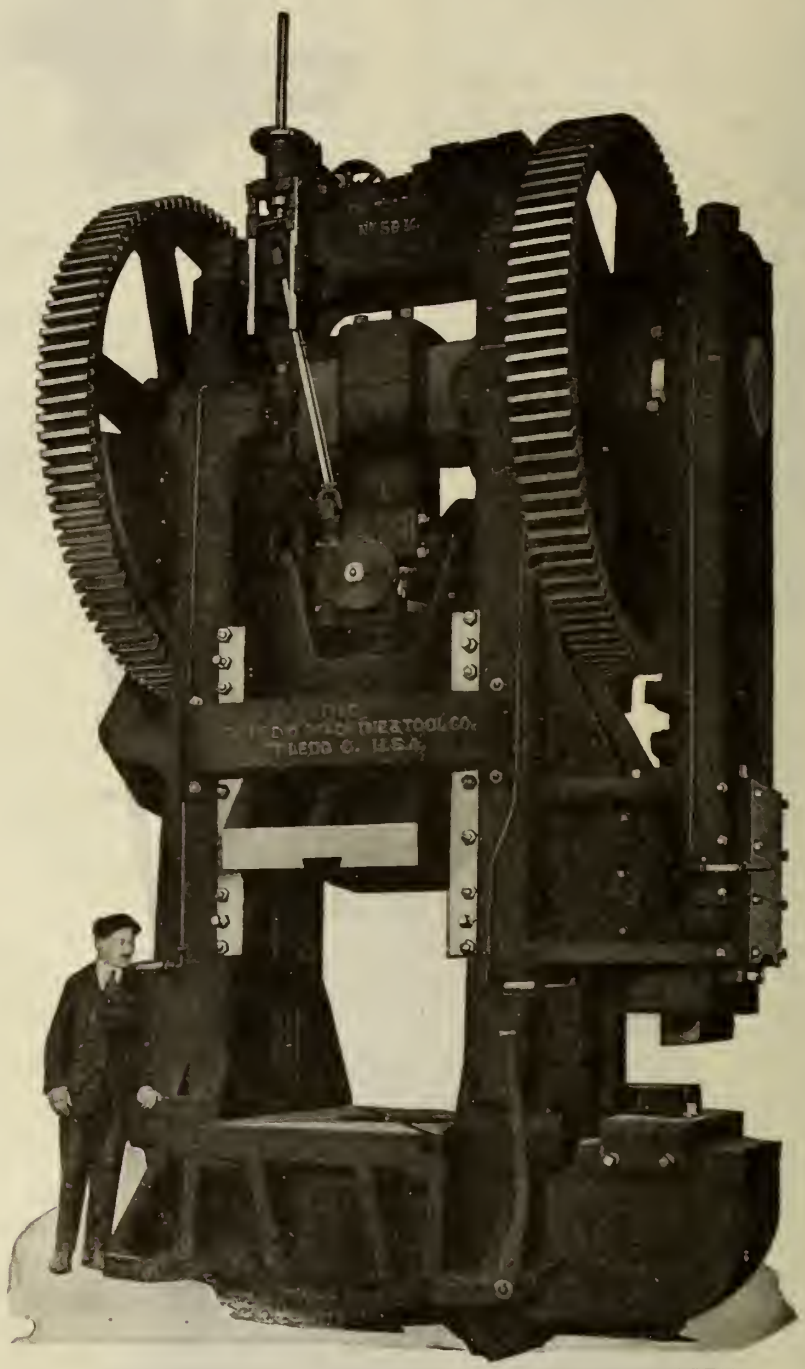
LARGE TRIMMING PRESS

The accompanying photograph illustrates what is said to be the largest single crank trimming press, with side shear, that has ever been built. The press has a number of special features which are worthy of note. The frame is of the four-piece steel tie rod type of construction, which consists of a base, two uprights and a crown, held together by four large steel tie rods which are shrunk into place. These four rods take the stress. The uprights are extra heavy to withstand any lateral stresses which might occur when the slide is unevenly loaded. Presses with this type of construction are capable of economically operating dies for the heaviest kind of work that can be done in presses. The twin gears on the main shaft are an original feature in a trimming press of this character, and it will be noted that the design is such as to make an entirely self-contained machine without any outboard bearings and with the main gears close up to the uprights of the press. The gearing, moreover, is mounted high on the frame and in no way interferes with the operator at the back of the press.

The outside shearing or cutting off slide is particularly massive and substantial. It is operated by an eccentric shaft, which extends through the bearing in an auxiliary housing, secured to the outside slide housing by steel tie rods. The press is controlled by a powerful hand actuated friction clutch which enables the operator to start or stop the machine at any point of the stroke. The slide is raised and lowered to the proper adjustment by a special power driven elevating device. This saves considerable time when changing dies of varying heights. All the main bearings are lubricated from the floor by a centralized forced feed lubricating system. The press is driven by a direct connected 50 H. P. motor mounted on a bracket at the rear of the machine.

This press is specially adapted for trimming crankshafts of twelve cylinder aeroplane engines, and it will readily trim other work of larger dimensions which is forged in 15,000-lb. hammers or even larger.

An idea of the size of the press may be had from the following dimensions: weight about 185,000 lbs.; area of slide flange F. to B. x R. to L. 68 x 40″; area of bed F. to B. x R. to L. 72 x 48″; standard stroke of slide 16″; distance bed to slide stroke down and adjustment up 30″; stroke of outer slide 6″; ratio of gearing 44:1; number of strokes per minute 7″; extreme height over floor 229″; floor space over all F. to B. x R. to L. 137 x 166″.



THIS VIEW GIVES A GOOD IDEA OF THE SIZE OF THE PRESS.

The above press has been designed and built by the Toledo Machine and Tool Company, Toledo, Ohio.

HEAVY DUTY BORING MACHINE

As far back as 1916 the Rockford Drilling Machine Co., Rockford, Ill., became convinced there was a demand for a single purpose heavy duty horizontal drilling and boring machine, which could be highly standardized, and still be flexible enough to meet practically any requirement. The result of this belief is shown in the two photographs herewith. The machine illustrated is one of three built for a large motor works, for boring crank shaft and cam shaft bearings. This machine is provided with two duplicate fixtures mounted on an index-

ing table. The loading station is at the rear of the machine, and the operating station at the front.

As a nucleus, the head of the Rockford vertical heavy duty drilling mechine, complete with drive gears, spindle and feed mechanism, was selected. This head can be shortened to give as little as 12-inch spindle travel or increased to give 40-in of travel. In combination with the different spindle designs and multi-spindle drive heads, it gives the means of rotating the bars and tools.

The main drive may be by either motor or countershaft. In the countershaft drive, a three step cone is provided and a Hyatt roller bearing tight and loose pulley countershaft. The motor is directly connected through gears and without the use of flexible couplings or chains. Interchangeable pick off gears are provided for speed changes with both types of drive. Feed changes are four in number and are incorporated in a simple feed box with drive-key. The feeds available are varied to suit the work but are always in geometric ratio with a factor of 1.5. A forward and reverse feed mechanism can also be provided. All bearings on both drive and feed are bronze bushed. The base is of heavy box section, well ribbed and is bolted together in such manner as to facilitate the changes in design without many pattern changes. The feed and drive mechanism are completely mounted on one base section and the fixtures are mounted on the other section.

While one fixture is being unloaded and loaded, and the bars and cutters changed at the loading station, the other fixture is at the operating station and the piece it holds is being bored. When these operations are complete, the operator disconnects the bars from the drive head and steps on the foot treadle which projects through the front side of the base. This treadle pulls the index pin and lifts the table slightly off its bearing on the base and on to a large ball. The table is then rotated 180 degrees, bringing the new job in line with the spindle and the finished job around to the loading station. This method of handling makes the operation almost continuous.

This machine bores two crank shaft bearings 2 9-16 ins. diameter by 2 3-4 ins. and 2 15-16 ins. long and three cam shaft bearings 2 3-16 ins., 1 57-64 ins. and 1 55-64 ins by 3 1-4 ins., 2 9-16 ins. and 3-4 in. long respectively, simultaneously in aluminum at a cutting speed of two hundred feet per minute and .010 in. feed per revolution of the spindle.

The operations are divided into rough boring, facing and finish boring, a machine being provided for each operation. All these operations with the addition of counter boring, drilling, etc., may be combined on one machine if the production does not warrant more equipment.

Care is taken in designing all fixtures to provide adequate clamping devices of such form that the case will be held firmly but not sprung out of shape. In this particular case, the lower surface of the crank case is clamped against hardened steel plates mounted on a vertical surface. This facilitates changing cutters and keeps the locating surfaces clean. Location of the case is by means of hardened dowels entering reamed holes in the lower surface of the crank case. These dowels are relieved of all cutting strain by means of spring plungers which are locked after the case is in position.

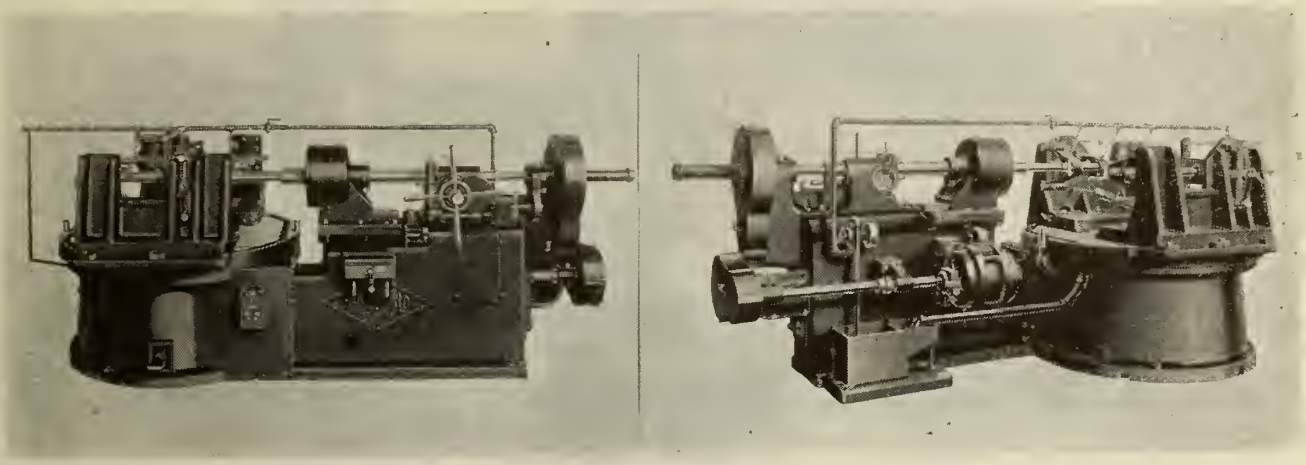
The equipment for the above includes a complete set of Kelly Reamer Co.'s bars and cutters. A floating drive is used between the bars and spindles so that the accuracy of the work depends upon the fixture alone. Liner bushings are provided in all cases so that it will be very easy to maintain alignment of the fixture. The bars are provided with wearing strips which may be packed up and re-ground to keep the bars up to the standard size.

These machines are adaptable to a wide range of work and are easily arranged to take care of holes from 1 inch in diameter in steel to 12 inches in cast iron and aluminum. They are rated at 2 1-2 in. diameter drilling from the solid in steel and have demonstrated their ability to withstand continuous production over a long period of time.

Following is a partial list of work for which these machines have been adapted: crankcase boring for tractors, trucks, and passenger cars; transmission case boring for the same; cylinder boring for tractors; front axle (king pin hole) drilling and reaming; rear axle drilling and boring; gun carriage work (77 m.m. and 150 m.m.); centering of large forgings; milling pads on crankcases; facing and counterboring bearings in crank cases and for double end drilling.

DUPLEX TURNING AND BORING MILL

An improved type of duplex turning and boring mill is shown in the accompanying illustration. This machine is an example of the new range of turning and boring mills being manufactured by Webster & Bennett Ltd., Coventry, England.



GENERAL VIEW OF THE MACHINE, SHOWING FRONT AND REAR VIEWS.

It is a duplex machine with 42-inch diameter work tables, each forming a separately driven and operated unit. The other sizes of machine, which constitute the full range, are 20 and 30-inch duplex machines, and a 30-inch single machine. The machines in each case are built on the unit principle. The machine illustrated embodies some new and distinctive features making for high productivity with a minimum expenditure of labor. All controls are centralized, rapid power traverse is applied to all slide movements, and special provision is made whereby the turret heads may be quickly and easily rotated irrespective of lack of balance, due to heavy overhanging tools.

The distribution of metal to give maximum strength has received special attention, and the main castings, such as the base, columns, cross slides, saddles and turret slides, are heavily ribbed to enable them to withstand the heaviest duties to

which, by recent advances in cutting tools, the machines will be submitted.

Evidence of the consideration in this direction is seen in the method employed in mounting the turret-head cross slide, which incorporates the narrow guide principle. It will be noted that the cross slide is supported by square and V-shaped gibs at the bottom of the slide. This design also gives a direct thrust to the cross feed screw, which is located in the lower portion of the slide way.

The machine is entirely self-contained, power being supplied through all-geared speed boxes, driven by two separate motors—one to each unit. These are mounted on platforms seen immediately behind the turret heads. Correct tension is maintained on the belt by arranging the platforms on a rocker, and by means of screw-operating mechanism the platform and the motor contained thereon may be tilted over until the desired belt tension is obtained. The gear boxes are of the sliding gear type, and give a wide range of table speeds, rising in geometrical progression. The speeds may be quickly varied by simple lever movements, and in order to prevent gear breakages through careless operating the friction driving clutch becomes disengaged before the sliding members can be moved. The left-hand table in the duplex machines is equipped with a reversing motion, which enables the operator, when turning and surfacing, to work with the tools adjacent to the tool control levers. For drilling and boring or reaming, standard tools are used and the table runs in the reverse direction, whereby a heavy outlay in left-hand tools is avoided. The feed changes are effected by hand levers through the different combination of sliding gears contained in boxes at the foot of the columns.

On the change levers are numbered plates which indicate at any time the actual feed engaged. All the driving gears are made of steel or phosphor bronze, and those in the speed box are of chrome nickel steel, heat-treated for maximum strength. A special form of tooth is used throughout in these gears which, together with the high tensile steel of which they are made, makes practicable the use of fine pitches and small diameters, thus strength is maintained and high peripheral speeds are eliminated. Lubrication to the gear boxes is effected by means of filtered oil through siphon tubes, and oil emerging at the end of the bearings is automatically returned into the box.

Control Features

The levers seen at the side of each table control all speed changes. The feed changes are made by means of levers on the top of the feed box, the direction of their application, however, i.e. to vertical or longitudinal feeding, is determined by the lever directly under handwheel at right hand side of photograph. Rapid or slow power traverse movement, in either direction, for convenience in setting the tool to the work, is actuated by means of the lever directly under the previous lever spoken of. By the above control arrangement, the operator seldom requires to move more than a few inches from the working position. Positive feeds may be instantly thrown out of engagement and rapid power traverse put into gear, thus enabling the turret to be quickly brought into any desired position, with the smallest expenditure of labor.

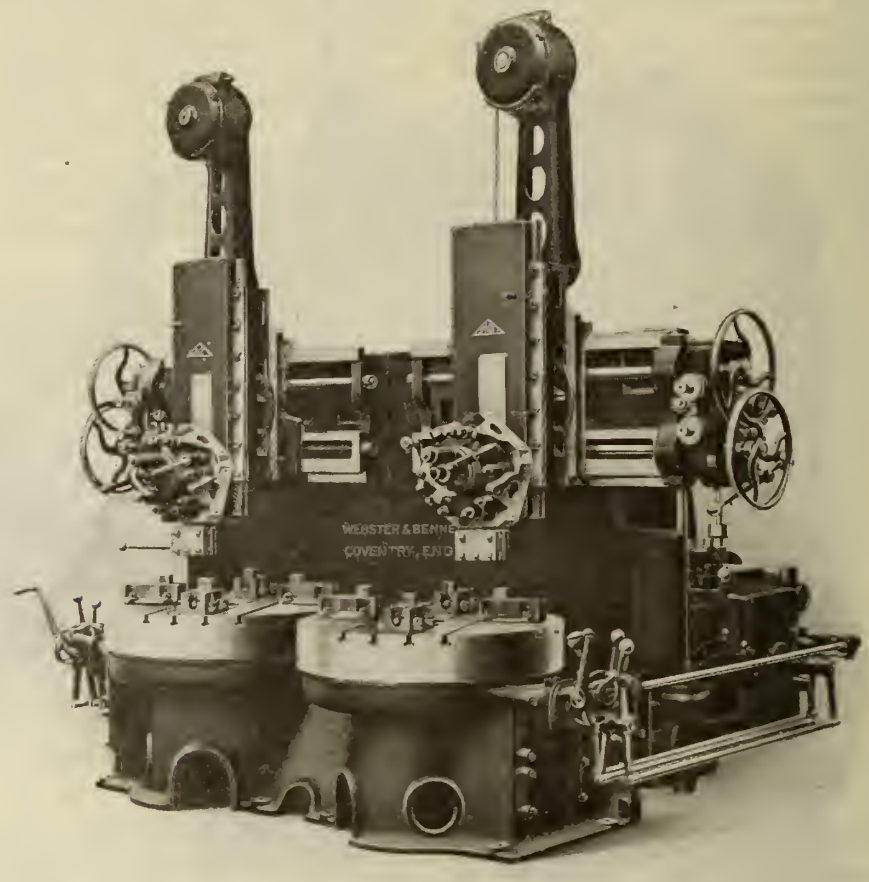
The latter lever has a compound movement, and actuates the positive feeds or the rapid power traverse motions in either direction. To operate the longitudinal traverse, the first lever is raised, then by elevating or depressing the second lever the slow or fast feeds are engaged. By moving this lever either to the right or left, the saddle is operated in a corresponding direction.

An automatic trip device is embodied in the feed motion, whereby the feed may be automatically tripped at any point.

Arrangement of the Turret Head

Another feature of this machine is the arrangement of the turret heads. These, as will be noted, can be set over to operate at an angle, and are counterbalanced by means of a powerful spring, actuating through wire cable over a fusee, thus maintaining a constant pull against the weight of the slides and tools at all times and in all positions. The arrangement is safe and compact and in no way restricts the movements of the operator. Within certain limits the displacement of the centre of gravity of a turret head, due as frequently happens to an unbalanced arrangement of the tools, is no disadvantage to the operator and no time is lost in bringing the turret into any required position. Beyond this a rotating mechanism becomes essential, both for the safety of the operator and as a waste time eliminator. On the 42-inch machine shown, arrangements are provided to neutralize the effects of overhang or heavy boring bars, tool holders and so forth, and the turret may be very easily rotated without the slightest risk.

To make a turret movement, it is first unclamped by raising the lever shown (which unlocks the turret from the slide), then by raising the lever on the left side of the turret, the indexing plunger in the turret is withdrawn, and by one revolution of the arm directly below this latter lever (which is geared by a pinion and internal gear to the turret) the next tool station is brought into the cutting position, after which it is locked by the two levers as before.



GENERAL APPEARANCE OF DUPLEX BORING MILL EQUIPPED WITH 42 INCH DIAMETER TABLES.

VARIETY SAW BENCH

The Oliver Machinery Co., Grand Rapids, Michigan, have placed on the market a new variety of saw bench. This machine is made in either motor-driven or belt-driven style. The machine is designed for the production of variety

wood work, wood patterns, furniture, automobile bodies, agricultural implements, etc. It will do ripping, cross cutting, and will cut mitres. In other words it is a wide range variety saw.

The construction is rugged throughout and all necessary attachments, such as mitre cut-off gauge, etc., are provided. Two types of tables can be furnished, plain and universal. The latter has a 15-inch rolling section to the left of saw, which rolls on ball bearing ways having vertical adjustment for alignment and wear. The rolling table can be moved four inches from saw, this permitting the use of dado saws and special heads. This table also permits doing accurate cross cutting, mitreing and grooving.

The table has a tilting device which consists of a hand wheel, worm and gear device, housed in a dust-proof casing attached to yoke with connecting link to table. This makes a positive and self-locking arrangement as a clamp screw is provided for positive clamping at any tilted position. The table can be tilted to 45 degrees to the left.

It has also a vertical adjustment, and if desired a plain table can be furnished. The universal table, however, is shown in the illustration.

It will be noted from Fig. 2 that the motor drive is not an afterthought, but has been built right into the machine; 5 horsepower is required when belt-driven, 3 to 4 horsepower when direct-motor driven. The motor on arbor machine is for 2 or 3 phase, 60 cycle alternating current. For other currents a standard motor running at about 1,800 r.p.m. is mounted on a sub base bolted directly to the main driving belt, thus eliminating the necessity of a countershaft. Motor pulley and belt are thoroughly guarded by suitable guard.

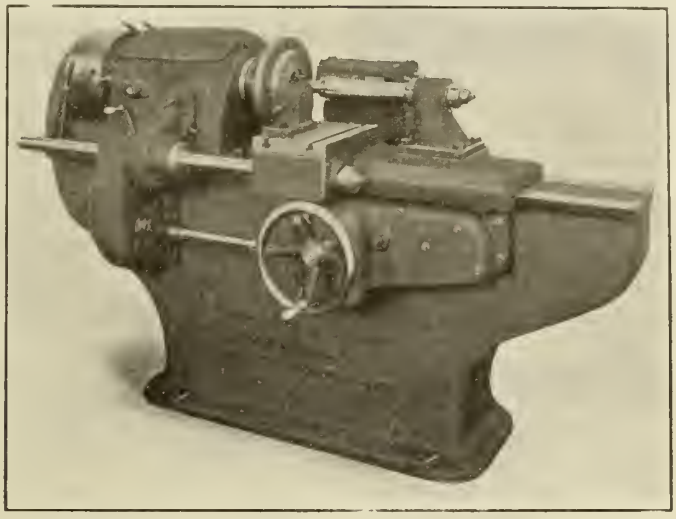
The saw arbor operates on ball bearings, and bearings are encased so completely that no dirt can come in contact with them. The arbor bearings are mounted in a one-piece rigidly constructed housing which is bolted and tongued to frame of machine. This housing is interchangeable as a unit with the motor head arbor when direct mounted motor is desired.

AUTOMATIC TURNING MACHINE

The machine depicted in Fig. 1 represents an entirely new development, manufactured by Thos. Ryder & Son, Ltd., Turner Bridge Works, Bolton, England. It is used for the turning of piston rings, and in fact is adapted specially to all motor manufacturing plants.

With the exception of checking the work, the machine is entirely automatic in action, and will simultaneously turn, bore, and part off bush castings into rings. Concentric or eccentric rings can be produced with equal facility. The machine can also be arranged to turn, the outside diameter, and simultaneously form the ring and oil grooves in piston castings. In such cases the piston is located on a spigot bar, controlled by a hand wheel at the rear end of the main spindle. As the action of this machine is automatic, one operator can attend to a battery of machines, thus effecting a considerable saving.

When producing piston rings, the bush casting is secured to a face plate fixture. The machine is started and on engaging the feed the operation proceeds as follows. Boring tools carried in a bar mounted in the saddle, and turning tools, mounted in the front tool post, commence cutting simultaneously. Next the parting tools, which are carried in a holder mounted on a cross slide at back of bed, begin to part off the rings one by one.

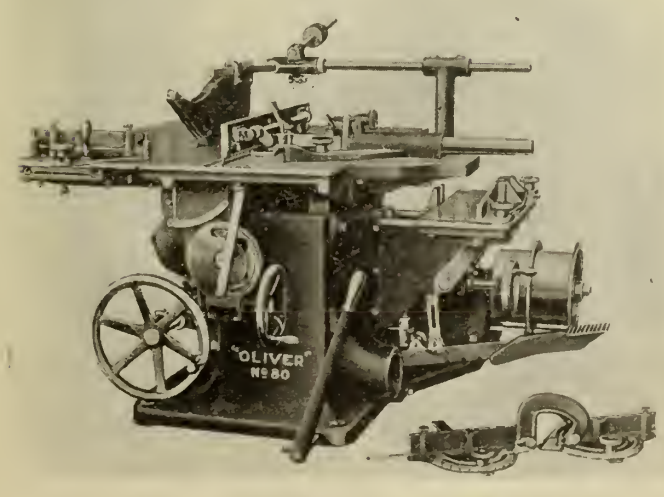


GENERAL APPEARANCE OF AUTOMATIC TURNING MACHINE.

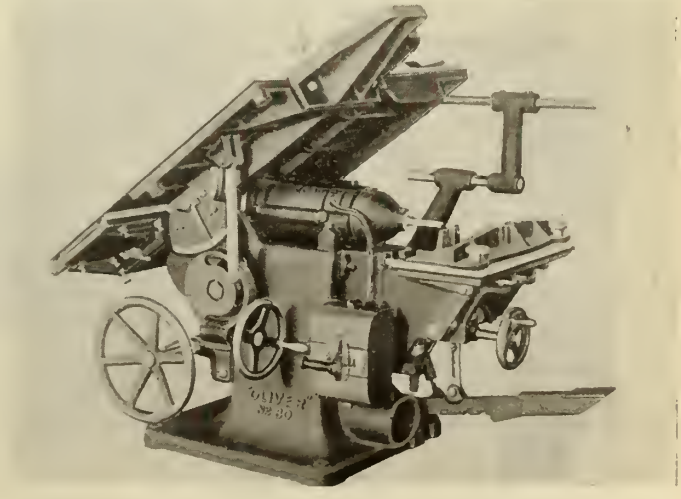
Operations continue until the turning and boring is completed, when the tools automatically stop.

The parting tools continue until the last few rings are cut off, and they also automatically stop. The machinery time for a normal 4-inch diameter ring is one minute.

The machine is of very rigid construction, and work produced from it is very uniform in character. The main frame is of a one piece box section and extends completely to the ground. Chutes are arranged to deposit the turnings away from the tools, slides, and moving parts. The latter are enclosed and protected from dust.



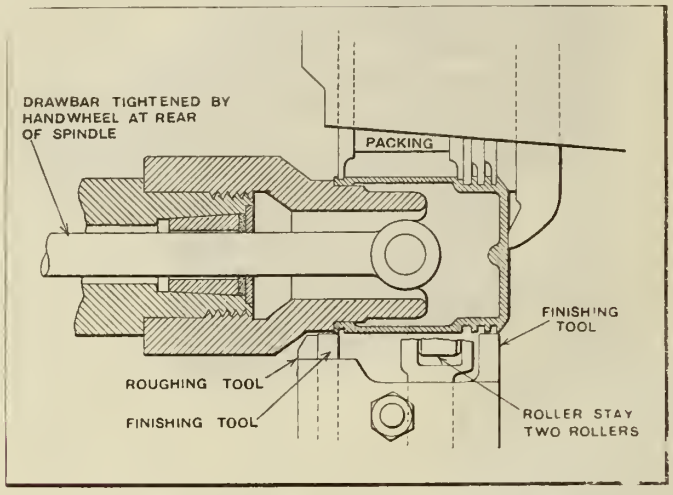
VIEW OF MACHINE WITH TABLE IN HORIZONTAL POSITION.



MACHINE WITH TABLE IN TILTED POSITION.

The drive is by fast and loose pulleys, through a geared head, giving a speed range between the ratios of 2 to 1. This allows for maximum cutting speeds. The main spindle runs in bearings of the firm's special cone-cum-ball bearing type, and splash lubrication is employed throughout. The slides carrying the turning, boring and parting tools are arranged with automatic feed and trip motions which are controlled by one handle only. When a complete cycle of operations is completed, one hand wheel winds the slides back to the original position, each slide keeping in register with the other automatically. The boring bar, as already mentioned, is carried on the saddle, where it is supported in a strong steady rest, and a pilot bush in the spindle nose engages the opposite end, thus ensuring great rigidity. Three boring tools are contained in the bar, which are of large section steel, sufficient to carry away heat. The foremost of these boring tools are circularly ground behind the cutting edge, and so act as effective following stays to the work.

When dealing with pistons, these are previously faced up and recessed at the bottom end, to act as a register on the spigot face plate of machine. The arrangement is shown at Fig. 2. The spigot face plate, which is open at the sides to admit the gudgeon pin bosses as shown, is screwed on to the spindle nose, the bore of the latter being utilized to carry a support bush for the draw back bolt. It will be noticed that the outside roughing and finishing tools are followed by two roller steadies, these withstanding the thrust of the grooving and heading tools carried in the back slide. In the case of pistons with a skirt of full diameter, the steadies traverse out of the way as the sliding proceeds, allowing the finish-sizing tools to follow for sizing the top bands.



ARRANGEMENT WHEN DEALING WITH PISTONS.

The maximum capacity of the machine is to turn pot castings up to 10 inches in length, and outside diameter of 8 3-16 ins. The maximum size of inside bore is 2 1-8 ins. Production times taken from actual practice have shown that pistons 4 1-4 inches diameter, 4 3-4 inches long, have been produced in 8 1-2 minutes each. It is said that one boy can feed three machines, owing to this machine's automatic action.

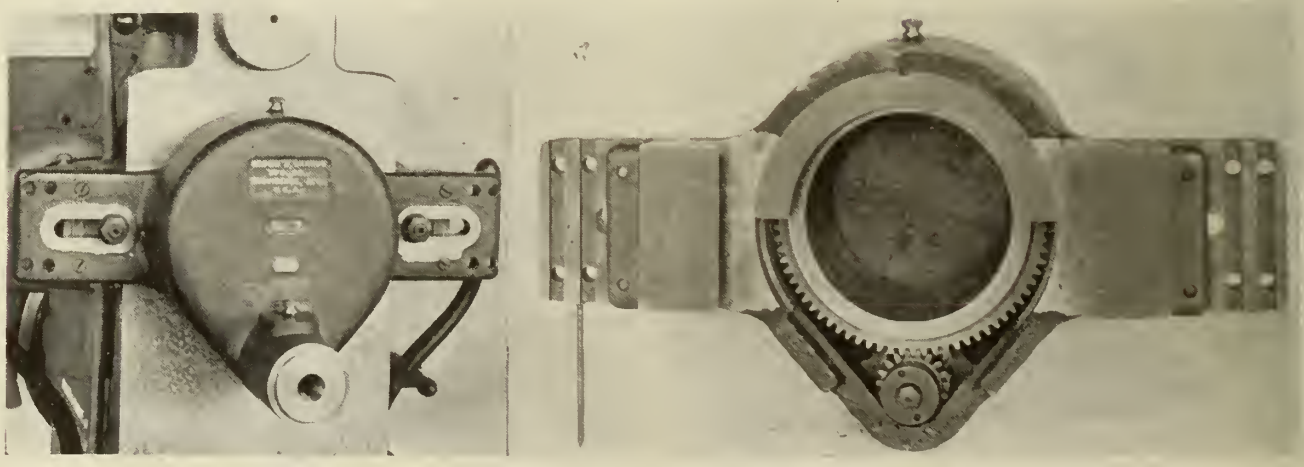
HIGH SPEED MILLING ATTACHMENT

The accompanying illustrations show a new design high speed milling attachment made by the Brown & Sharpe Mfg. Co., Providence, R.I., for use on milling machines of their manufacture. As will be noted the mechanism is simple in construction and easily attached, no fixtures being required. The bracket and spindle support is a one-piece casting of substantial construction, so designed to protect the mechanism from dirt and injury.

The attachment is built in two sizes, the No. 1 for the smaller machines, and the No. 2 for the larger machines. The No. 2 size is adaptable by means of adjustable gib stops to the larger machines, having columns with different width of face, thus eliminating the necessity of a separate attachment for each different size of column on machine.

The positive means of locating the attachment is worth noting. To assure a positive vertical position, the attachment is provided with a locating segment which rests upon the spindle box of the machine. This spindle box projects beyond the face of the column and acts as a centering guide. The horizontal position is determined by first tightening the gib on the right-hand side of the attachment, thereby locating the attachment. The gib on the left-hand side securely clamps the attachment to the face of the column. This affords a large bearing surface, insuring rigidity and making the attachment practically an integral part of the machine.

Particular attention has been given to the drive that it may be positive, though simple, the only gearing being the large ring gear that fits on the taper nose spindle of the machine and the pinion on the attachment spindle. The large gear is made with an internal taper, ground to fit on the taper nose of the machine spindle and is held in position by the regular cutter driver. This gear is made of machinery steel and left soft to insure a smooth drive and eliminate chatter, also the objectionable "ring"



GENERAL APPEARANCE, AND DETAIL VIEW OF HIGH-SPEED MILLING ATTACHMENT.

often produced by hardened gears at high speed. On the No. 2 attachment the pinion is heat treated and keyed to the attachment spindle, while on the No. 1 attachment the teeth of the pinion are cut directly on the spindle.

The spindle is hardened and ground and runs in a long phosphor bronze bearing, the bearing being tapered so that wear is taken up by tightening an adjustment nut, thereby forcing the spindle into the taper. Once having adjusted the spindle a small set screw securely clamps the adjusting nut in position. End thrust is taken by hardened steel and babbit washers located directly behind the shoulder on the front end of the spindle. The front end of the spindle has a taper hole to receive cutters, the smaller attachment having a No. 7 taper hole and the larger one a No. 9 taper hole. Oiling of the spindle bearing is effectively taken care of by means of an oil pocket on the front of the attachment containing wool which insures a constant and even distribution of the oil at all times.

The cutter is held in position by the taper in the spindle and is driven by the tenon. Cutters are readily removed by a releasing bolt which provides a positive means of ejection. This bolt is a part of the attachment and remains in the spindle.

CONCENTRIC CHUCKING

The importance of the chuck as a lathe accessory is too often imperfectly appreciated. The chuck is an indispensable link which connects the work to the source of power and it is obvious that the selection of an efficient chuck is of the greatest importance — otherwise one may have a costly and productive lathe stultified by its inefficiency. The desirable features of a chuck can be summarized as follows: Gripping power, strength, durability and adaptability.

The Coventry concentric chuck, illustrated, made by Alfred Herbert, Ltd., England, is said to embody all these features. Fig. 1 illustrates the chuck with one sector plate and jaw slide removed and from this, the principle of operation can be followed.

The work-gripping jaws are attached to radial jaw slides by square-headed collar screws, engaging nuts which slide in "tee" slots in the jaw slides. Both the base of the jaws and the front face of the jaw slides have fine pitch serrations which engage each other and positively prevent relative movement. The jaw slides are of "tee" section and are held in place by sector plates which fit inside the rim of the chuck body. The jaw slides are moved in and out by a scroll which is rotated through gearing. The scroll has three eccentric grooves in its face, each groove carrying a sliding block which pivots on the cylindrical portion on the jaw slide. The eccentric grooves are portions of a circle, and the sliding blocks are therefore in contact over the whole of the wearing surfaces, a result which is obtainable with spiral scrolls. Dimensioned circles on the face of the chuck facilitate the setting of the jaws.

The exceptional gripping power claimed by makers for this chuck is obtained by the high ratio of gearing used and the efficient design of scroll. The chuck is said to have exceptional strength, and on this point it is interesting to note the claim made by makers "that no Coventry chuck body has ever broken in use, and no body returned to them broken from any cause whatever."

Durability of this chuck is claimed by the makers on the grounds that all the component parts are of the highest class of material, and the refinements in design are such as to prevent rapid wear.

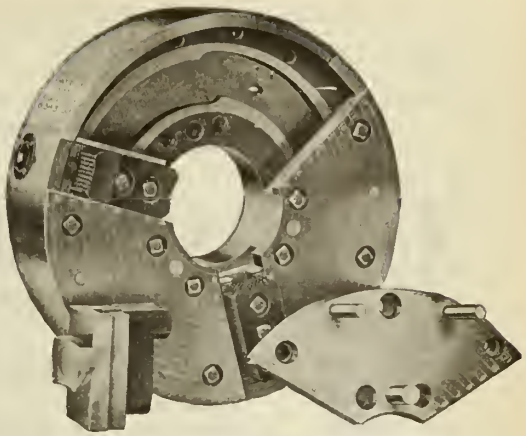


FIG. 1—THE CHUCK WITH ONE SECTOR PLATE AND JAW SLIDE REMOVED.

The makers' claim for adaptability is well illustrated in the accompanying illustrations, Figs. 2 and 3, showing respectively the chuck holding a gas engine cam, illustrating the convenience for gripping irregular or eccentric work, and a back axle casing, an example of the ease with which jaws can be applied for holding objects of irregular form. In this case the jaws shown are exceptionally long, two projecting 5 inches from the face of the chuck and the third 3 1-2 inches. They are shaped to suit the form of the work and arranged so that a five point grip is obtained, making it impossible for the work to rock. This concern carries a stock of soft jaws which customers can conveniently shape to their requirements.

The Coventry concentric chuck is made in six sizes, 9-inch, 12-inch, 15-inch, 18-inch, 21-inch and 25-inch. We have received from the Canadian office of Messrs. Herbert, Ltd., 1-3 Jarvis Street, Toronto, a copy of their booklet entitled "Concentric Chucking" which is something out of the ordinary in this line. Those interested in the question of chucks and chucking fixtures, can obtain a copy upon request.

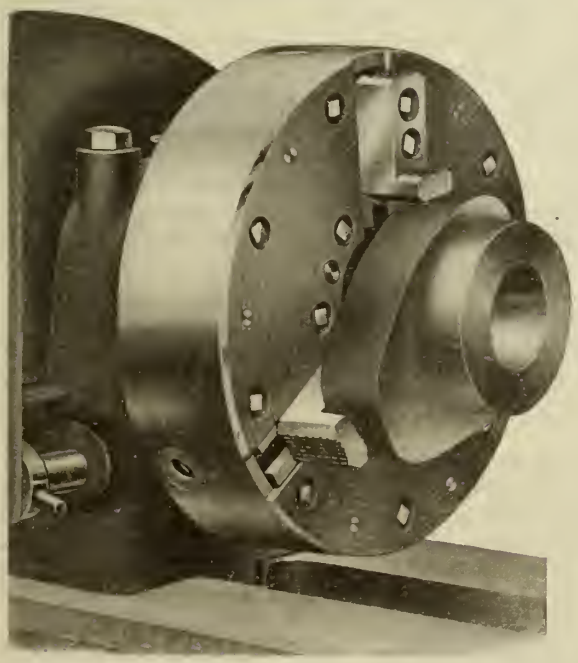


FIG. 2—GRIPPING A GAS ENGINE CAM WITH PERFECT EASE

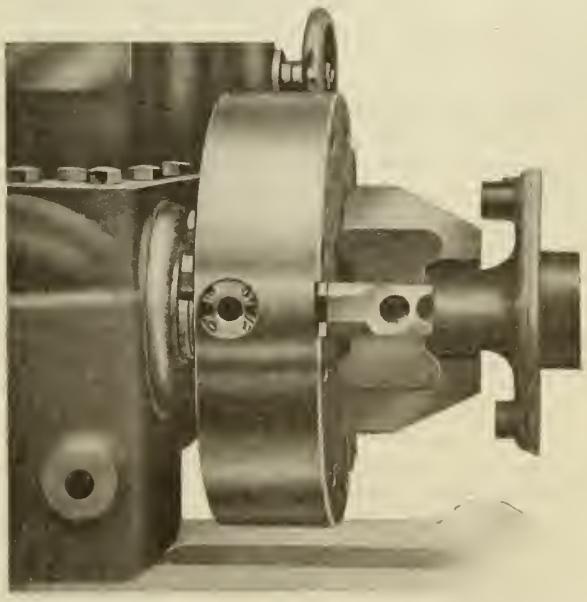


FIG. 3—NOTE THE CHUCK'S ADAPTABILITY ON THIS CLASS OF WORK.

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The Land of Achievement

WHEN one reads the phrase "The Land of Achievement" in a publication issued in New York, it would require no great stretch of imagination to surmise that United States was referred to. In this case it is not. "The Land of Achievement" is Canada, and the publication comes out under the auspices of the Bankers' Trust Company:

"As an evidence of Canada's phenomenal development the latest available figures indicate that the Dominion in relation to nine other industrial countries now stands first in area, second in potential water power, third in total railway mileage, fifth in total exports, sixth in pig iron production, total exports and foreign trade and eighth in population."

Canadians too often get the idea that other countries have a supply of super-men, while at home we have been served with a very average sort. After reviewing Canadian history since 1867, and paying a remarkably fine tribute to Canada's war record, the Bankers' Trust Company refers as follows to the men of Canada who have made this country what it is to-day:

"Needless to say, such a record of achievement as is afforded by the history of Canada during the fifty odd years which have elapsed since 'Dominion Day,' 1867, is not due to chance. Canada has been fortunate during this period in having in political life and in business a group of able, resourceful, morally strong, patriotic men who were not alone capable in action, but capable in leadership. They could not have achieved if there had not been working with them a splendid body of intelligent, determined and resourceful citizenry, men and women of moral force and courage, such as a new country alone seems to develop."

There is need right now in Canada for a decent appreciation of our own people, of our own institutions, resources and possibilities.

In our efforts to go into the markets of the world we need the confidence that comes from a knowledge that we CAN do things in this country.

We need to have developed in our national mind—and we must have a national mind—the idea that we have taken our place among the nations of the world.

Canada is suffering now because her own people simply assent to many of these things. They have never been seized by them, nor have they taken any of the inspiration in to board with them, either in their homes or in their business.

It is well that some enterprising outsider should now and then send out the fact that CANADA IS.

The way in which American settlers are coming to this country with their effects and their cash and the number of American firms already established here and coming over in 1921 is evidence that they have a lot of real dollars and cents faith in the future of this country. Were there any doubt in the matter, these shrewd people would not be staking millions of dollars in property and building here.

Get it, friend, get it. You are living in a real country, and if you are not plowing your field here, someone from the outside is going to see the chance and come in and ultimately reap the harvest.

No Sense of Responsibility

ONE of the lamentable traits that keeps coming to the surface in our industrial life is a lack of sense of individual responsibility for acts done in a collective way.

To illustrate:—A few days ago some forty boys, from 15 to 18 years of age, went on strike at the plant of the Canada Car and Foundry Co., at Fort William, because they were refused an increase from $5 and $5.50 per day to a schedule that would bring them $7 per day.

They promptly walked out, and as a result four hundred men in the plant were forced to quit work. These four hundred had no grievance with the firm, yet they were made idle because forty youngsters thought they could run the works.

It is not likely that any one of those forty boys would care to face those four hundred men and assume responsibility for forcing them out of work, and yet that is exactly what each one did.

The theory, too widely accepted, that there is no individual responsibility for acts done collectively, is a vicious thing, and yet it is surprising the number of people in the industrial world who cling tenaciously to it.

With stores shouting half-price sales and New York funds dangling around 18 per cent., a person has to have a pretty fair education to reckon what his week's pay is really worth.

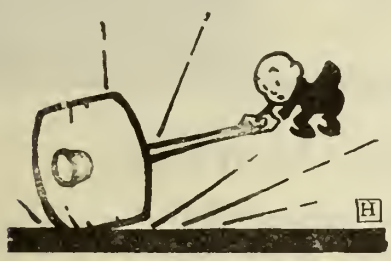
Doctors in Paris believe that the skin may be so developed that it may perform the function of eyes. Thus will preference be given to the man who sprouts an eye in the back of his neck when a foreman is wanted for a gang of day workers.

The death of Horace E. Dodge following, within a few months the passing of his brother John F., removes from the mechanical world two brothers who started in a small way, faced the vicissitudes of business and conquered. The father of these boys was the owner of a small machine shop, in which the lads learned their trade and undoubtedly learned it well. They made typesetting machines, then bicycles. Following this they turned to automobile parts and then to the finished article, until to-day their plant covers over 100 acres of floor space.

TWO HOMELY LITTLE SERMONS FOR NEW YEAR

Of Course We Don't Refer to You

WERE someone to come around and suggest you were a knocker it may be that you would look highbrow and announce that you did not understand. Well, we'll tell you. Knocker is a pretty fair term—has some strength in it, and is part of the direct action vocabulary that is coming in every-day use when people want to say something when they speak.



Knocker means complainer, whiner, joy-killer, pessimist—a combination of all these things.

In high-up circles they call him a critic, or in a more high-up a critique. In other ultra-pink atmospheres he's labelled a connoisseur. But in honest-to-goodness language he's a knocker just the same.

If he agitates, he never seems to head his movement in the right direction. He uses up his energy to bust up things that his poor little fists could never construct again.

Then there's the different types. There's the chap who can't be chalked up as a noisy knocker. He doesn't exactly set to and heave the mallet in any particular direction.

But he does it in another way. If there's anything in the shop looking toward bettering conditions or securing better results, this bird does not get out on the steps and tell the sun what he thinks of it, neither does he call the boss on the 'phone at his house to tell him the dice are loaded and he won't play.

He's just a lukewarm oyster and about as palatable as a mouthful of soap.

He whispers to his neighbor in the shop, and his whisper puts the spike in any enthusiasm there might be in his corner of the works.

Perhaps he does not intend to be a brakesman on the train of progress, but he's certainly not tossing any fuel into the engine.

This chap is apt to be a poor prune at home. He's a mighty poor source of inspiration for the little woman who fell for his courtship guff, and as a father he's a blank for the children to copy. It would be the part of wisdom for Kith and Kin to forget him until he sprouts a little human enthusiasm and lets the shrub have a chance to grow a bit.

Say, chap, if you want a real tip and one that won't cost you the spending of one red cent—here 'tis—get enthusiastic.

Get in behind something worth while in the plant, in your community or at your own home. Put that little old hammer out on the porch where someone is sure to steal it and bear it away. There always will be some knockers, but for goodness sake don't get mixed up in the scramble for the available supply of hammers.

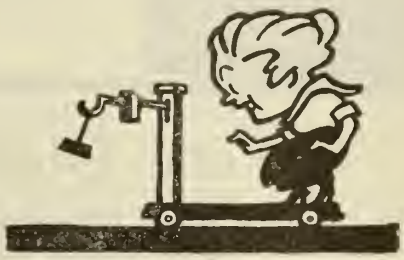
Just a few months ago the man around selling steel was grabbed as soon as he came on the premises and rushed into the combined hospitality of the general manager, the purchasing agent and the superintendent. Today he sits on the bench and waits his turn.

In November, United States settlers entering Canada brought with them $17,519,033 in money and settlers' effects. There might well be a tear trickling down Uncle Sam's cheek as he waved farewell to this delegation.

Better Weigh in Now and Then

THE man whose job it was to clean out the premises of a big publishing house was making his rounds the other night carrying out the scrap paper accumulation of the day.

In one department he came to a big paper container that was so full that much had tumbled off on the floor. That basket looked for all the world as though it had done a good day's work.



It looked as though it had collected a tremendous pile of paper, so much in fact that it was absolutely unable to have another piece tossed at it or near it.

It had the premises around it all mussed up as though to bear witness to the fact that it was an overworked basket.

When the janitor came along he simply looked at it and grunted, and there wasn't even the suggestion of pity in the grunt.

He didn't even say that he'd have to get another basket to stand alongside of the one that seemed so overworked—nor did he say that this basket should only work a few hours and then be let off for the rest of the day.

Not a bit of it. He simply put his big, substantial foot in the basket and jammed that seeming overcrowded load into a little heap down at the bottom.

Then he gave the basket a shot and started it down the hall toward the baling machine.

Say, when that basket was all puffed up with scrap paper and wind and space, you might have been certain it would have made the baler puff to get away with the load. In the end all that frothy load made only a very small little filler in the corner of the baler of paper that was shipped out the next morning.

Did you ever run into any of those big, loose, puffed-up, overworked baskets in the shape of men?

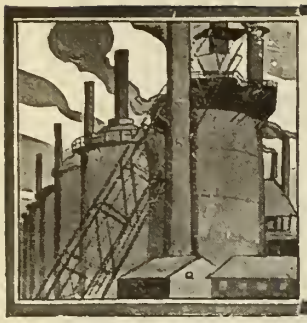
Of course we don't mean you, but of course you know some person else that fits into this story like a fat woman into the average street car seat.

Always puffing around, looking wise, telling the world of the amount of overwork that is heaped on them, posing for the spotter who searches for the super-man, always keen to admit the boss doesn't bulge their pay envelope in keeping with their real weight in mental gold.

You know the rest. Some day they go up against the real thing. Some crisis or lesser event comes along and puts the foot and the pressure on them. They give and they quash, and they crumple up to next to nothing. When they are put in the baler there's not much left. When the wind and the froth and the boast are punctured there's mighty little left.

Better step up on the scales now and then to find out just how much is real and how much is just filling and padding.

The removal of the luxury tax leaves automobile dealers in a peculiar position. They have paid it to the makers and cannot collect it from the customer. If the Government refunds the amount it will defeat the aim of the tax. It goes to show that all matters of taxation and of tariff should be made as stable as possible in order that the business world may have a chance to study them and adjust their affairs accordingly.



MARKET DEVELOPMENTS



Very Quiet Period in all the Markets

Steel Mills Are Down For Holidays, and the Independents May Cut Wages Before They Open Again—Corporation Mills Still Well Employed—Toronto and Montreal Doing Little Trading

THE end of the year finds the machine tool trade quiet in all departments. New York reports more inquiries, but no sales. Toronto and Montreal have somewhat the same experience and look for improvements early in the year.

The steel market is in the same position. Values are easing off a little more, bar material, both iron and steel, being marked down by fractions this week. An interesting situation is developing in the steel rolling district of United States. Most of the independent mills are down for the holiday week and it may be they are down because they have no orders to go on with. Will they reopen at the same wage scale, or will this be the chance to make a reduction?

Several of the independent companies have already announced reductions as high as twenty per cent., and they are working under these conditions now. The Corporation, on the other hand, with its books well filled with tonnage, is not likely to make any move in this direction for the present.

Talk of there being reduction made in steel prices has little sympathy now. It may be that the independents will announce their affirmation of the Corporation schedule. All the large mills have made money in recent months and are not in a position where they have to operate regardless of profit or loss. This being the case it seems unlikely that a runaway steel market can develop.

The scrap metal market ends the year in the dumps. There is nothing in sight to show where any betterment will come from. Even at the low levels quoted, nothing is being traded, and foundries and steel mills refuse to stock up, although it would be to their advantage to do so in some lines at least, as any sort of a buying movement will be sure to have the effect of stiffening prices.

LITTLE BUSINESS IS DONE IN MONTREAL AT THE YEAR'S END

Special to CANADIAN MACHINERY.

MONTREAL, Que., Dec. 30th. — The closing days of the year emphasize the dullness that has been more or less pronounced in many lines of activity during the past several weeks. The crowning event of the period of quiet trading has been the present holiday season, bringing forth an almost total absence of interest in all branches apart from that of retail domestic business. The closing of many industrial plants and the general tendency to shorter work days on the part of those factories continuing operations has still further added to the lull that has settled over many of the country's activities.

Plate and Sheet Prices Revised

There is little to feature trading in steel commodities. Buying is almost entirely confined to essential requirements, and the general trend to inactivity or curtailed operations in various lines of industry, only emphasizes the attitude of buyers. It may be truly said that this does not represent a healthy condition, but it is undoubtedly the reaction consequent on the abnormal state of world trade during the period of the war and the two succeeding years. As one dealer stated—"it is not that industry is in a poor state of health, but rather that it has come to the point where the war paint must be washed off and replaced by more appropriate clothing suitable to the needs of the changed conditions."

"We are passing through a period," continued the dealer, "when we usually expect to experience a falling off of inquiry and demand, but there is no denying the fact that the present is more than ordinarily quiet, and this must be laid to the imperative need that is everywhere evident for establishing a firmer foundation upon which to build the industrial trade of the future, and the coming year in particular. We are more than hopeful that the early spring will prove the time for the laying of the corner stone of the redesigned business structure."

Local steel trading is at low tide this week, due to combined circumstances; holidays and festive season has diverted interest to domestic activities, and more than seasonable slackness in many plants and factories has added to the uncertainty that nearly always influences consumers towards a non-buying policy. Dealers here anticipate a few weeks of quiet buying, but will not commit themselves further. Base quotations on iron and steel bars, from Montreal warehouses, have been revised downwards, the price now being 4½ cents, a decline of ½ cent per pound. Prices on plates are likewise lower, ¼ inch and up being quoted at 5 cents, and 3-16 inch at 5½ cents per pound. Black and blue annealed are easier, showing a drop of ¾ cent per pound, 28 gauge black being listed at $8.50 and blue annealed No. 10 are quoted at $7 per hundred. Quotations on Premier No. 28 are now 10 cents and on 10¾ oz. the price is 10½ cents, a decline of 1½ and one cent respectively.

Machinery Need Is Evident

The past week has been more than usually quiet in machine tool circles.

The curtailed activity of many manufacturing plants has acted as a barometer to the purchasing departments, and in many instances the buying of equipment has been deferred to a more favorable time, or at least until the resumption of activity necessitates the installation of the additional tools, or the replacement of others. Inquiries coming in to the dealers would indicate that consumers and users on many lines of machinery would be in the market if they could assure themselves of an early return of industrial enterprise. The buy-

ing of supplies is lessening and future demand is comparatively quiet.

Dullness to Continue

The passing of the old year finds the old material market in the same stagnant condition that has featured its existence for several weeks back. That the early future holds little of interest is the opinion of many dealers, but some are looking forward to more active business as the winter is advanced. Prices which have obtained for the last month are still quoted but should be considered as nominal only, nearly every sale being made on its individual merits. If anything, the prices quoted are above those paid by the dealer.

WINDING UP THE YEAR'S AFFAIRS

Nearly All the Firms Have Had a Good Year, Though Hard to Get Required Material

TORONTO. — Many of the machine tool houses are busy just now getting their affairs of the year in readiness for the preparation of annual statements. They are finding out now whether they have bought wisely and turned over the stock quickly enough. One Toronto manager, speaking of this matter said this morning: "It is much harder running a business now than it was a few months back, when everything was on a rising basis. Then we could go ahead and buy, knowing that before we would get rid of the lot the price would have gone up again. The makers in many cases were so busy that it was impossible to buy too heavily, as their capacity prevented that. Just now it is quite different, and we are working in a declining market, and supplies must be bought with that in mind. When we send out a requisition now we inquire about delivery on the lines mentioned before placing the order. If we find that the deliveries are all right and can be made from stock, as a general thing we cut the requisition in two, knowing that we can order from stock at any time and get supplied. If we find deliveries are delayed we allow the requisition to stand. I don't suppose it means that we are doing any more or any less business, but it protects us in a market that is on the way down, and we feel safer for the present going along that way."

Have Had a Good Year

Machine tool men are not complaining about the business they have done during the year, neither are they willing to admit that it has been as profitable as the insistent nature of the demand might lead one to believe. Deliveries were very backward in the schedules of a good many makers, and in this way the dealers were not able to get through as much business as otherwise would have been the case.

Neither is there any complaint made right now, although sales have been few during the week. There is a certain feeling that business is going to be better, and that once the corner is turned the recovery will be quite brisk and satisfactory. Dealers are doing very little buying for stock, being content to place orders when they have a sale, knowing that in nearly every case they can secure tools out of stock now, something that has been quite out of the question for a good many months—yes, years in many lines.

The Steel Market

The year just closed has been a good one and yet a disappointment for many firms in the steel business. Good because there has been plenty of business —disappointing because of their inability to secure material in sufficient quantities to take care of the business that was offering. It is quite correct that many yards have done a larger volume of business and made less money than many people imagine. Merchants, rather than let their stocks run out, were forced to buy where they could, and paid premiums that had the effect of shoving up the price. In this way they could not recover the same margin as when they were selling at normal figures, and more money has been required to finance the same volume of business.

Hard to Secure Material

There have been several months in this year's business where firms in Canada which had to have steel in order to run their business have been put to no end of trouble to keep things moving in their direction and no small amount of enterprise has been displayed in a number of cases. For instance, the makers of agricultural machinery have kept men in the rolling mill districts, and at junction points and at any other spot where they felt it would be necessary to give attention to the movements of their shipments. This was especially so during the strike on the railroads. One firm which depended on a supply of cold rolled kept their own crews in the mills, where they were being looked after, and their own trucks, taking the material as soon as it left the mills and trucking it some twenty miles to the nearest point where railway connection could be secured. It cost a lot of money to see that shipments were turned out and headed toward the Canadian border, but if the Canadian consumers did not take these precautions they were faced with the poor alternative of shutting down their plants until conditions should right themselves. All this activity cost money and plenty of it, and increased costs of manufacturing in Canada in a way that is not generally appreciated by those who did not have to face the conditions described above.

Little Buying Now

The close of 1920 finds buyers in general standing pat in the matter of placing business. Many of them are full of

POINTS IN WEEK'S MARKETING NOTES

Steel and iron bars are quoted in Montreal warehouses at 4½ cents a pound, being a reduction of ½ cent from the last price.

—

Machine tool men as a general thing have had a good year's business, the one drawback being their inability to secure delivery when the selling was good.

—

The steel warehouses are rather quiet this week and buying has narrowed down to immediate wants. The warehouses themselves are not taking in very much material.

—

The end of the year finds the scrap metal market in much the same condition that has prevailed for the last three months. Many of the yards are doing practically no business at all and more money is being lost than made.

—

The majority of the independent steel mills are idle for the holiday week and there is some speculation as to when they will open again.

—

A number of steel mills in United States outside of the Corporation have announced reductions in wages, running as high as 20 per cent. A wage reduction by the Corporation is not looked for at the present time.

—

There is less talk heard just now of any reduction being made in the price of steel and it seems likely that the schedule of the Corporation will be approved by the independents and there the matter will rest.

—

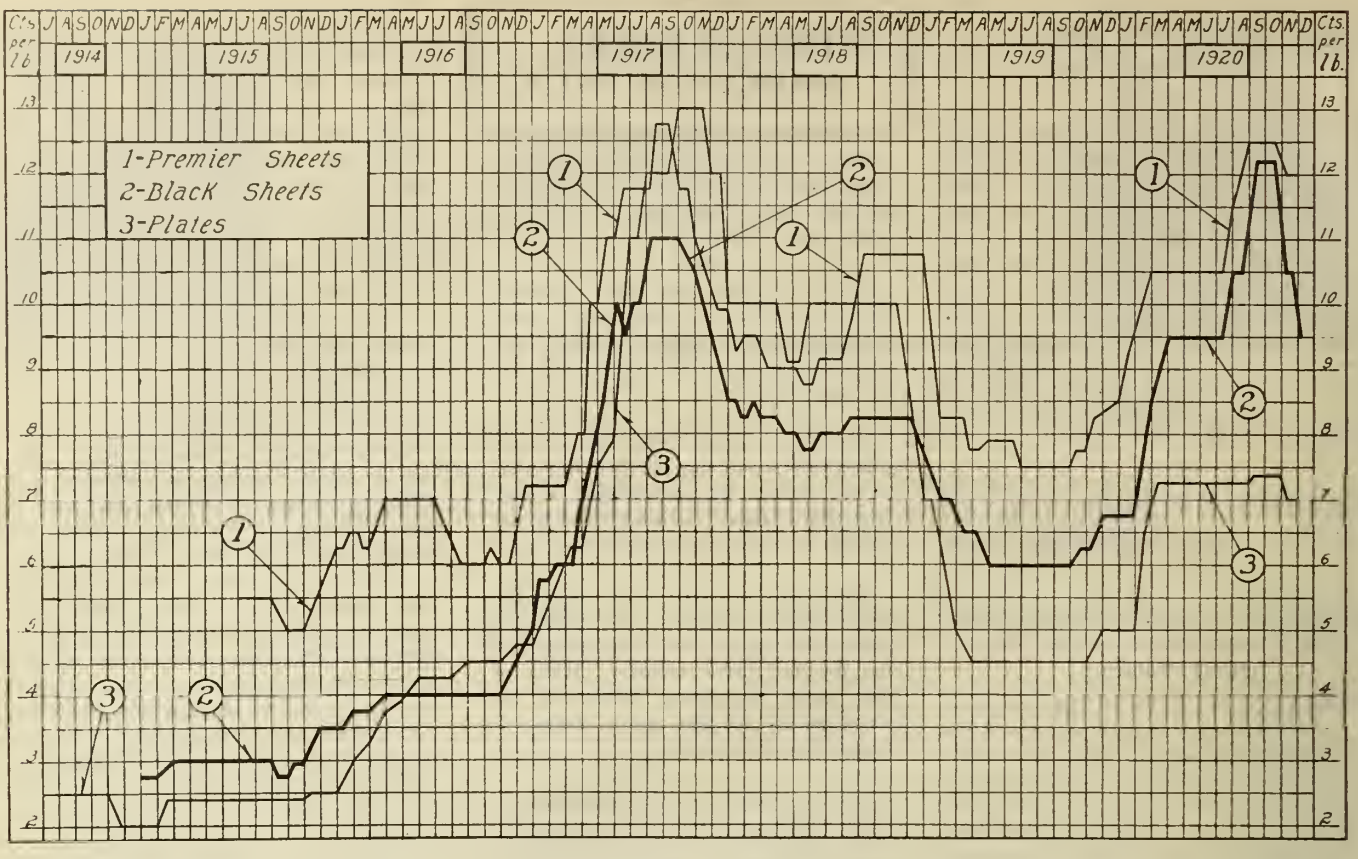
The selling of small tools is done only in small lots and users are not taking on anything in the way of surplus stock.

—

Representatives of Canadian firms returning from England report that German goods, especially all lines of cutlery, are being sold in London stores and are giving more competition to British goods than was thought possible a few months ago.

—

Very little pig iron is being sold in the United States or Canada at the present, and the market appears very weak. A requisition for a good sized tonnage would probably set a new low level.



PRICE CHANGES IN WAREHOUSE QUOTATIONS FROM 1914 TO 1920.

ideas as to why others should rush into the market and buy heavily, but they cannot see for a minute why they should follow the same course themselves. Warehouses probably have sufficient to meet the demands of the present, which are fairly light.

Information from some of the large steel concerns warrants the belief that they are not looking forward to any extended period of depression. They claim that steel bought now is for actual and immediate consumption, and in this way none is being piled at the yards or at the plants of the consumers. Cancellations are not as serious as was anticipated, and many applications of users for cancellations have been converted into business again with delivery for the first quarter of 1921.

MORE INQUIRIES IN NEW YORK MARKET

But These Have Not Been Changed Into Real Businesses Yet—Next Year's Prospects

Special to CANADIAN MACHINERY.

NEW YORK, Dec. 27.—The year 1920 has been one of ups and downs in the machine-tool trade. The early part of the year was marked by very satisfactory buying, which began to taper off about the middle of the year, although some companies had good business up until September. The slump which hit the automobile industry was the beginnine of a downward trend in orders, which by the end of the year had reached a point of stagnation. Not in many years has the machine-tool industry of the United States known conditions so quiet as those through which it has passed in the last two months.

All eyes are naturally turned toward the new year, which is expected to bring forth some improvement. The tangible evidences of this prospective improvement are to be seen in a fairly good number of inquiries received in the past month or six weeks, most of which have not been acted upon. In postponing purchases those companies which have made inquiry have announced that buying will not be done until after January 1. Whether this means immediately after the turn of the year will be determined only by events. There is a hopeful feeling however, that there will be a gradual resumption of business beginning with January 1 or at the latest by February 1.

Christmas week was not productive of much new business or inquiries, nor is anything important expected to develop until after New Year's.

INDEPENDENTS MAY CUT WAGES BEFORE THEY START WORK AGAIN

Special to CANADIAN MACHINERY.

PITTSBURGH, December 30. — The great majority of the independent steel mills are practically idle this holiday week. Some had previously closed, but the bulk of the closing was done Christmas Eve. At some of the plants there were intimations that there might be resumption Monday, January 3, but it is very doubtful whether there will be much resumption at that time. A mill would not resume unless it had accumulated a fair volume of specifications during the period of idleness, as all the mills that closed had first completed all business on books. Then there is the matter of wages, as most of the independents are disposed to reduce the rate. In the past two weeks, prior to this week, operations by the independents, considering that some were closed entirely, probably averaged between 30 and 35 per cent. This week, with few plants running at all, and then only at low rates, the average of the whole is probably under 10 per cent.

The United States Steel Corporation has closed a plant or department here and there for the holiday week, not on account of lack of orders, but for the purpose of making necessary repairs or to allow one department to catch up with another. The major portions of the Pennsylvania tube works in Pittsburgh and National tube works at McKeesport are down for the week, one to make repairs and the other to allow finishing departments to work up stock, accumulated by the primary operations getting

The Deciding Factor

AT this season of the year, we wish to extend to our many patrons, thanks for co-operation during the past and the assurance of our best efforts in the future, to provide that satisfactory service on which all true success is built.

As Canadians, we have confidence in Canada and Canadian institutions. We believe the future is secure, not so much on account of our unrivalled natural resources and the potential value of our manufacturing industries, but because, in the development of the Canadian Nation, we have learnt to know ourselves. Under exceptionally critical circumstances, the inborn genius of the Canadian people has invariably risen to the occasion. It is this sure knowledge of our capabilities, which will be the deciding factor now, and in the days that are ahead of us.

Our Service Department is imbued with the spirit of optimism, which is so necessary to the accomplishment of successful enterprise. Bring your problems to us. The experience of more than half a century, in working out the solution of manufacturing difficulties, is yours for the asking.

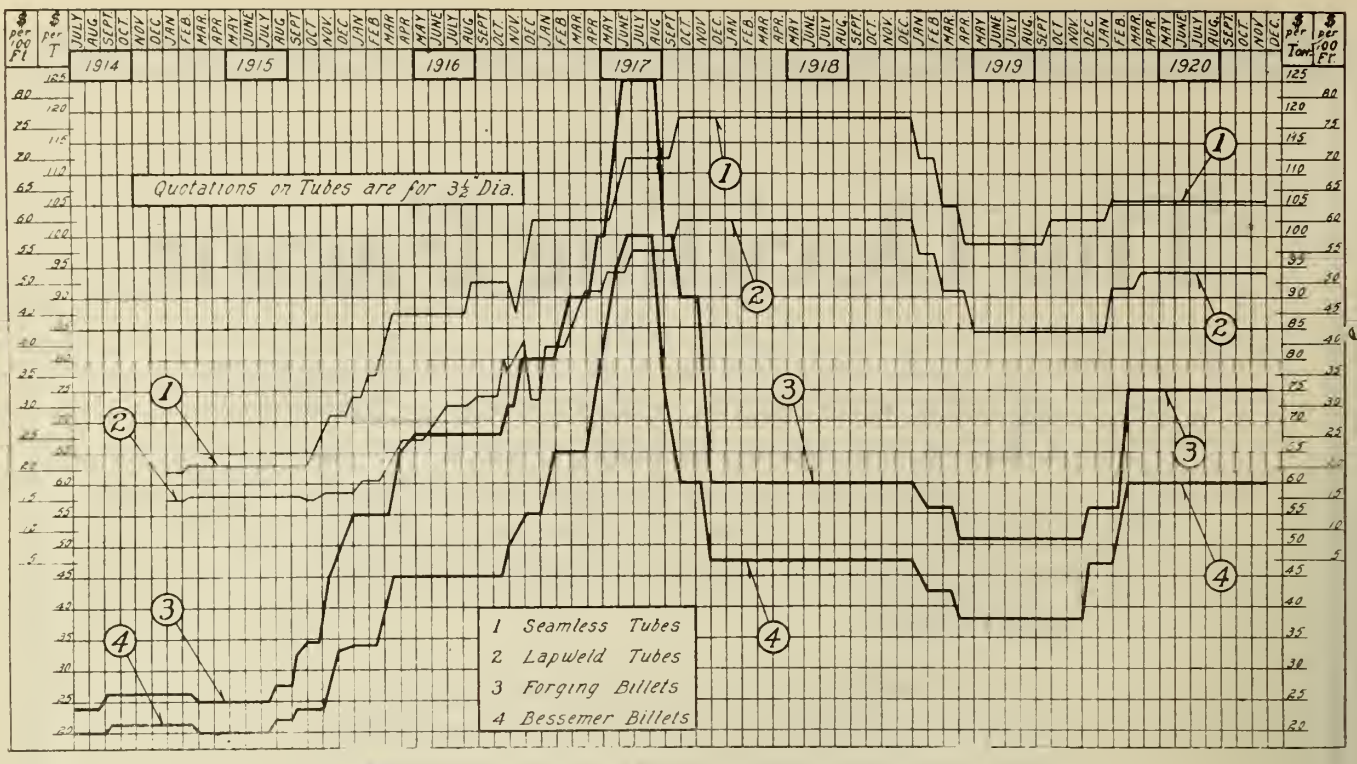
If it's Machinery—Write "Williams"

The A. R. Williams Machinery Company, Limited

TORONTO, CANADA

Halifax St. John Montreal Winnipeg Vancouver

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THIS TABLE SHOWS PRICE FLUCTUATIONS FROM 1914 TO 1920.

ahead. Apart from temporary closings this week the Steel Corporation is operating at over 90 per cent., or at a better rate than its average during the first ten months of the year.

Wages

It seems to be an established fact that the Steel Corporation will not reduce wages at this time, or until there has been a material change in conditions, particularly the corporation's own position, from that now existing. The independents are strongly disposed to reduce wages, but the Steel Corporation leadership, quite conspicuous in the various wage advances of the past five years, is absent. Furthermore, the independents do not confer together on any subject, either prices or wages, that having been considered undesirable for years on account of the state of public sentiment. Thus there is no opportunity for the rise of a general policy and each independent has to "go it alone." A few of the mills have taken action already. The Midvale Steel & Ordnance Company has made reductions at its Johnstown and Coatesville works, in Pennsylvania, the Wheeling Steel Corporation, operating chiefly in the Wheeling, W. Va., district, and a plant at Buffalo have lately announced reductions, to be effective this week, averaging about 20 per cent., with elimination of overtime payments in addition. Possibly some additional announcements will be made this week. A common guess is that many independents will announce wage reductions before they resume operations, the time of resumption being uncertain. If this proves to be the case it is probable that by about the middle of January the majority of independents will have announced wage reductions.

The problem is a difficult one for the independents. There is the lack of Steel Corporation leadership, already mentioned, on which the independents have so often depended, in various matters, in the past. Then there is the difficulty that while in some respects January 1 seems a good date for a wage reduction, the cost of living has been decreasing more or less steadily and further declines are expected in the future, while furthermore men would be more ready to accept a reduction after they had had a period of idleness. In particular, the cost of living depends largely on retail store prices and it is the feeling of all steel manufacturers that the retailers have not reduced prices as they should. A wage reduction, particularly in a town where the employees of the plant involved furnish the chief custom for the retail stores, would stimulate the retailers to reduce their prices. Thus, from one viewpoint the employer should wait for the cost of living to come down, while from another viewpoint he should make the reduction at once in order to help the cost of living to decline. One idea has been this, to make a small reduction now and another later, but a difficulty about this, in the minds of some of the steel makers, is that upon the appearance of the second reduction the buyers of steel would probably feel that they were entitled to lower prices. According to what practically all the independent mills say now, the Steel Corporation or Industrial Board prices are going to be maintained indefinitely, and thus anything that would encourage talk of lower steel prices would be very objectionable. There are some observers, however, who insist that no matter how steel producers talk there will eventually be lower prices for steel before there is any general buying movement and before prices firm up and start advancing again. No definite predictions are made as to when such declines will come, whether in two months or many months.

Steel Prices Held

The finished steel market, as far as quoted prices go, is holding better than many people expected. There are some reports of price cutting, but not many, and in general the markets are being held. This may possibly be due to there having been so little enquiry that adequate temptation to cut prices has been lacking, and if so the turn of the year may see a more open market, for such a period of dullness as has prevailed in the past few weeks cannot be prolonged. There is another point, however. A mill cannot operate economically unless it has a fair tonnage. To cut prices and get a light operation would hardly pay, complete idleness involving less loss. As the steel mills are all in very comfortable position financially they have no incentive to operate except to make real profits.

The independent market on standard steel pipe continues at $7 to $10 above the Steel Corporation or Industrial Board list. There is a rumor that some or all of the independents will issue a new card January 1, conforming to the standard card. While the pipe mills have been running very well on orders they have had some cancellations and postponements and cannot run on orders

Continued on page 216

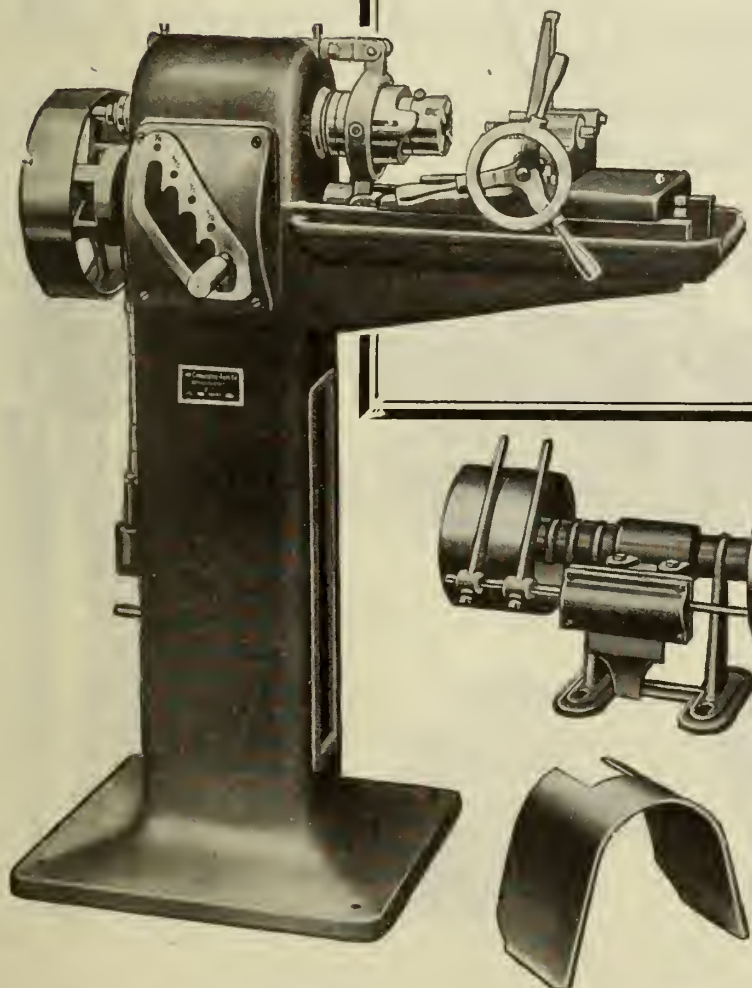
THIS WAY, PLEASE

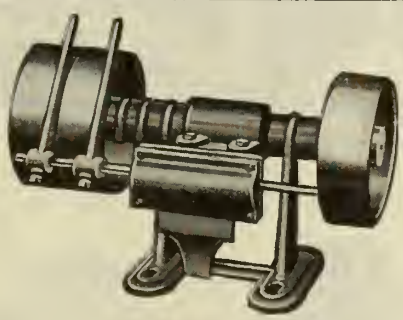
Where quantity and exactness have to be considered, the Geometric Threading Machine is just the way that suits. These machines have been tested and proved over and over again on speed, accuracy and endurance.

Geometric Threading Machines are employed on a large class of small threaded parts that cannot be produced economically on the ordinary screw machine.

Made in three sizes—to cut 1/8 to 1/2 inch, 1/4 to 3/4 inch, and 3/4 to 1 1/2 inch diameter threads. The carriage is mounted on slides and on the largest size machine is moved back and forth by rack and pinion, and in the smaller sizes by hand.

Spindle speed changes readily made, adapting the machine to the diameter and material of the work. An adjustable stop assures accurate length of thread, and automatically opens the die head, permitting of drawing the work straight back.





A line from you brings full details regarding this machine. Tell us your threading requirements—let us recommend the proper Geometric Collapsing Tap or Self-opening Die.

THE GEOMETRIC TOOL COMPANY
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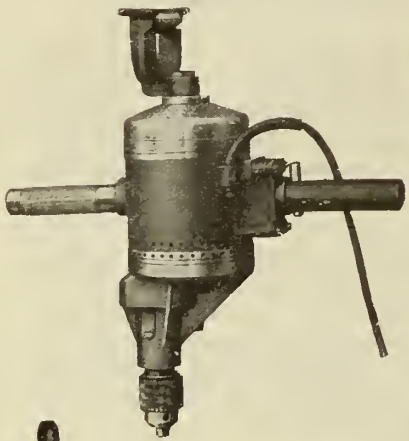
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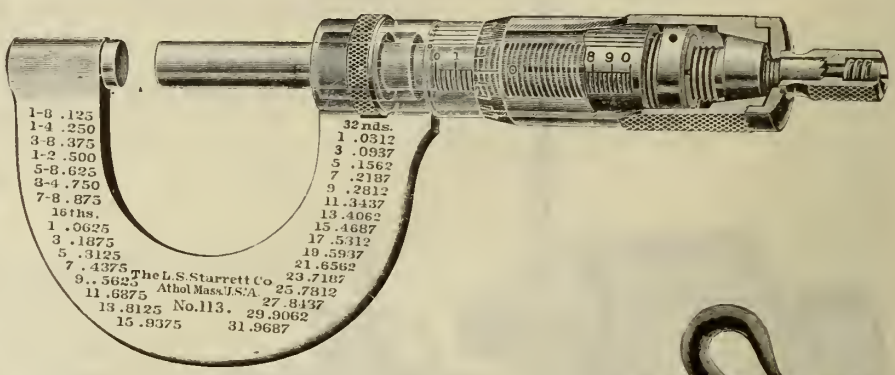
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Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

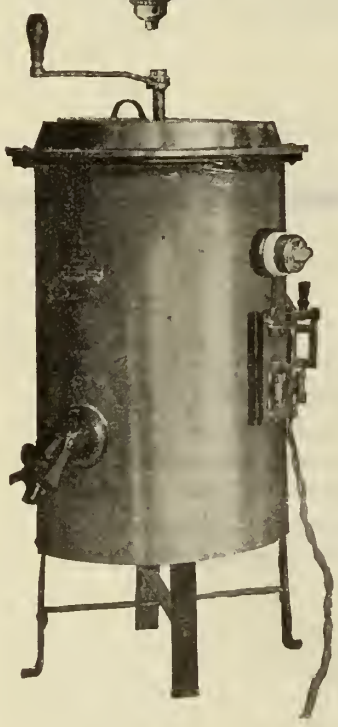
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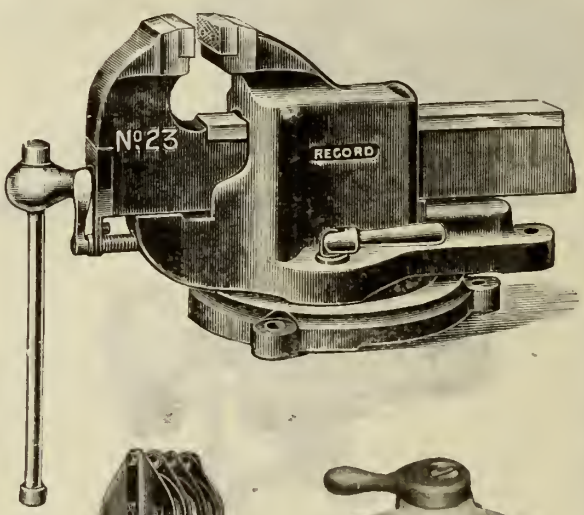
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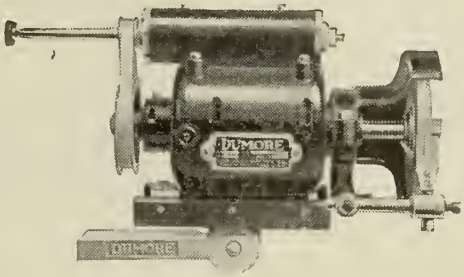
Canada's Leading Tool Supply House

The reputation of a manufacturer's product is his greatest asset. The firm which represents him to the purchaser must have a reputation equal to his own.

Aikenhead's is the Canadian headquarters of many makers of the world's finest tools.

DUMORE

High Speed Electric Grinders



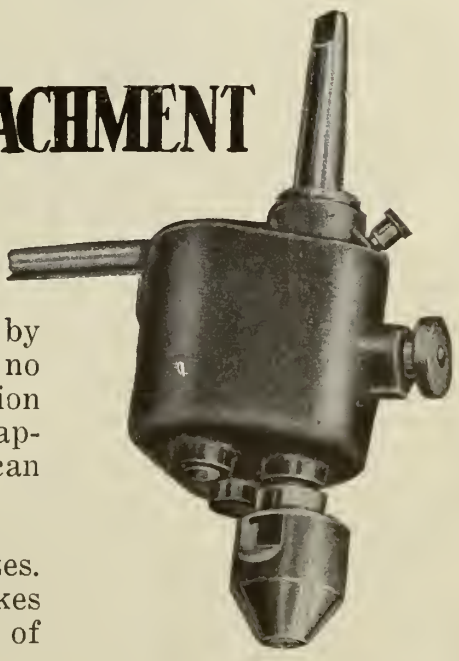
Dumore Portable Electric Grinders are extremely light, powerful and accurate. These features, and the high speed at which they may operate, have made them standard equipment in thousands of machine shops and tool rooms. Dumore Grinders are made in styles for all small grinding. Their speeds run as high as 50,000 R.P.M.

30,000 R. P. M.

Once you use them, you'll find them indispensable. See Aikenhead's for a free trial.

WAHLSTROM'S TAPPING ATTACHMENT

Eliminates Tap Breakage



The Wahlstrom prevents the tap from jamming in the hole by keeping the lands free from chips—consequently there is no tap breakage. The chips are freed by an oscillating motion which duplicates the simple to-and-fro motion of hand tapping. For tapping in soft materials the oscillating motion can be changed to a continuous revolution.

The Wahlstrom fits any drill press. It is made in two sizes. No. 1 takes taps of all sizes from 5-40 to ½ inch, No. 2 takes taps from ¼ inch to ¾ inch. It has nothing to get out of order. **Write Aikenhead's for fuller particulars!**

Aikenhead Hardware, Limited

17 Temperance Street, Toronto, Ont.

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MAY CUT WAGES

Continued from page 212

for more than a very short time longer. However, it is the regular thing for pipe mills to carry stocks and ship from stock rather than current production. Hence the mills may hold their prices and make stock, as they have practically no stocks at present. The old practice may be resorted to of putting out a 30 or 60 days' guarantee, whereby if a new list should be issued, say February 1 or March 1, all shipments to jobbers' stocks for 30 or 60 days previously would receive an adjustment equal to the reduction.

A little foundry iron has changed hands at $35, valley, enough to show that the quotable market has not changed. Bessemer and basic have remained stagnant, with prices nominally unchanged at $35 and $33 respectively, valley. The idea has become prevalent that some of the furnaces will formally announce price reductions January 1 or within a few days afterwards, possibly to about $30 for basic iron. The date has some significance, since several of the furnace interests will then get on to lower priced coke contracts and thus will have lower costs.

Some additional contract furnace coke business for the first half of the new year is reported as closed on the general basis of 5 to 1 against basic pig iron at valley furnaces. On $30 pig iron this would mean $6 for the coke. Altogether about 75,000 tons a month has been put under contract on substantially this basis.

NEW INDUSTRY AT PORT ARTHUR

In a large advertisement appearing in a recent edition of a Port Arthur paper, there is an announcement of the Port Arthur Shipbuilding Co., in which is recounted the falling off in the shipbuilding industry. The announcement goes on to state:

"Anticipating this condition of affairs, we have commenced the construction of pulp and paper machinery, and compressed air mine shovels, which work will, we hope, take up the slack caused by the falling off in shipbuilding. We have, however, in this new line, to go into competition with established manufacturers of long experience in this class of work. To succeed will mean not only continued prosperity for us, but the continuation of our quota of the prosperity of our city and the steady employment of the men who comprise our organization. Such success is what we are striving to attain for 1921, and we ask each and every one of our employees to unite with us in this purpose for the good of all concerned, and the welfare of the city in which we live. Of the citizens of Port Arthur, we ask a continuation of the co-operation and goodwill that they have given us in the past."

IRON, STEEL AND METALS SHOULD BE IN DEMAND DURING YEAR 1921

By W. S. LESLIE, of the A. C. Leslie & Co., Montreal

THE past year has been one of great changes in the metal market, some of these having proved disastrous to many manufacturers and dealers.

In iron and steel the scarcity prevailing at the end of last year was continued for the greater part of 1920, this condition being intensified by transportation difficulties, especially by the long drawn out strike of switchmen in the United States and also by the shortage of fuel. This shortage resulted in an abnormal advance in price of coal and coke, which forced makers who did not control their own supply to further advance their prices for iron and steel products, and, while the United States Steel Corporation steadily maintained their prices, they were unable to keep up with their deliveries and even buyers who had contracts running at moderate prices were obliged to go into the market and pay heavy premiums for prompt or fairly prompt delivery. For the past few months, however, transportation conditions have been about normal and the fuel situation having been considerably relieved, makers have greatly improved their deliveries, and on this account the premiums commonly paid have been greatly reduced. In fact, the market is getting down to a point somewhere near the level established by the Steel Corporation.

This downward movement has been quickened and carried farther than would naturally have been the case by extensive cancellations and postponing of deliveries on the part of buyers, chiefly in the automobile and allied industries, and these conditions have naturally made buyers hold back and probably they are carrying this policy to an extreme.

British manufacturers were able during the year to regain some of their lost trade in Canada, being assisted by the scarcity of American material and the low rate of Sterling exchange. Great Britain also, and probably their products, will be more in evidence in the coming year. Already a considerable quantity of galvanized and a smaller quantity of black sheets and tinplates have been imported and prices now being quoted are interesting for delivery at points where freight rate favors British imports.

The high price of fuel, however, in Great Britain and a shortage of pig iron have prevented any reduction in prices of the less manufactured forms of iron and steel that would make shipments to Canada possible.

The course of the non-ferrous metals has been most erratic. For the first five or six months of the year, tin, copper, lead, spelter and other metals were all very strong, though prices of some, more especially copper and spelter, were not abnormal compared with pre-war levels. A very serious slump, however, has since taken place in all these metals and values have apparently been carried lower than cost of production justifies, with the possible exception of lead, the supplies of which are comparatively small. Financial reasons, coupled with the fact that these metals are speculated in very heavily, account largely for the continued slump, and while there should undoubtedly be a good reaction in price of these metals, it is a question how soon this will take place. Certainly there must be more confidence than now exists before the market will be stabilized.

From what I have said the present would appear to be a time for buyers to continue a cautious policy in purchasing without allowing themselves to run out of supplies, but there is no reason why the demand for iron, steel and all other metals should not be good during the coming year, as there is a large amount of buying to be done when buyers have sufficient confidence, and are able to finance their requirements.

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We make Kwik-Kut Power Hack Saw Machines which use practically the full cutting edge of the Hack Saw Blade at each stroke; Metal Cutting Band Saw Machines for general shop work, cutting all classes of metal up to 12 x 14 inches.

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SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$39 96
Lake Superior, charcoal, Chicago	53 50
Standard low phos., Philadelphia	44 79
Bessemer, Pittsburgh	41 96
Basic, Valley furnace	37 50
Toronto price:—	
Silicon, 2.25% to 2.75%	51 50
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 4 75
Steel bars, base, Toronto	4 75
Iron bars, base, Montreal	4 50
Steel bars, base, Montreal	4 50
Reinforcing bars, base	5 50
Steel hoops	6 00
Tire steel	5 00
Spring steel	8 00
Band steel, No. 10 gauge and 3-16 in. base	5 50
Chequered floor plate, 3-16 in.	8 50
Chequered floor plate, ¼ in.	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	3 50
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	5 50
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 67 to 5 50
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	58½	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

METALS

	Gross Montreal	Gross Toronto
Lake copper	$19 00	$19 50
Electric copper	18 50	19 00
Castings, copper	18 00	19 00
Tin	44 00	46 00
Spelter	8 50	9 00
Lead	7 50	8 00
Antimony	8 00	9 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 5 50	$ 5 50
Plates, ¼ up	5 00	5 50

PIPE—WROUGHT

Standard Buttweld Pipe
Per 100 Ft.

	Steel Blk.	Steel Galv.	Gen. Wrought Iron Blk.	Gen. Wrought Iron Galv.
⅛	$ 6 50	$ 8 50	$.....	$.....
¼	5 31	7 41	5 91	8 01
⅜	5 31	7 41	5 91	8 01
½	7 10	8 63	7 95	9 48
¾	8 80	10 87	9 95	12 02
1	13 01	16 07	14 71	17 77
1¼	17 60	21 74	19 90	24 04
1½	21 04	25 99	23 79	28 74
2	28 31	34 97	32 01	38 67
2½	44 75	55 28	....	....
3	58 52	72 29	....	....
3½	74 06	90 62	....	....
4	87 75	107 37	....	....

Standard Lapweld Pipe
Per 100 Ft.

	Steel Blk.	Steel Galv.	Gen. Wrought Iron Blk.	Gen. Wrought Iron Galv.
2	$32 01	$ 38 67	$35 71	$42 37
2½	48 26	58 79	54 11	64 64
3	63 11	76 88	70 76	84 53
3½	75 90	92 46	85 10	101 66
4	89 93	107 55	100 83	120 45
4½	1 05	1 29	1 30	1 54
5	1 22	1 50	1 52	1 80
6	1 58	1 95	1 97	2 33
7	2 06	2 53	2 53	3 01
8L	2 16	2 66	2 66	3 16
8	2 49	3 07	3 07	3 64
9	2 98	3 67	3 67	4 36
10L	2 77	3 41	3 41	4 05
10	3 56	4 39	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger, 50%.
4" and under, running thread, 30%.
Standard couplings, 4-in. and under, 30%.
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds Montreal	Per 100 Pounds Toronto
Copper, light	$10 50	$10 50
Copper, crucible	13 00	12 00
Copper, heavy	12 50	12 00
Copper wire	12 50	12 00
No. 1 machine composition	13 00	12 00
New brass cuttings	7 00	9 00
Red brass turnings	10 00	10 00
Yellow brass turnings	7 00	7 50
Light brass	5 00	5 00
Medium brass	6 50	6 00
Scrap zinc	5 00	5 50
Heavy lead	5 25	5 60
Tea lead	2 50	3 00
Aluminum	16 00	16 00

	Per Ton	Gross
Boiler plate	$11 00	$12 00
Heavy melting steel	18 00	23 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	20 00	25 00
No. 1 machine cast iron	32 00	33 00
Pipe, wrought	8 50	10 00
Car wheel	30 00	33 00
Steel axles	20 00	20 00
Mach. shop turnings	8 00	9 00
Stove plate	23 00	25 00
Cast boring	8 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	+10
Carriage bolts, ⅜-in. and less	Net
Coach and lag screws	—15
Stove bolts	55
Wrought washers	—25
Elevator bolts	+10
Machine bolts, 7-16 and over	+10
Machine bolts, ⅜-in. and less	+10
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 50
Nuts, hex., tapped	add 3 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws —20% 25 and	5
Sq. and hex. hd. cap screws	12½
Rd. and fil. hd. cap screws	plus 25
Flat but. hd. cap screws	plus 50
Fin. and semi-fin. nuts up to 1-in.	12½
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	—5
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	+12½
Studs	+5
Taper pins	—12½
Coupling bolts	+40
Planer head bolts, without fillet, list	+45
Planer head bolts, with fillet, list plus 10 and	+55
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	+60
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add +85
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross t
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

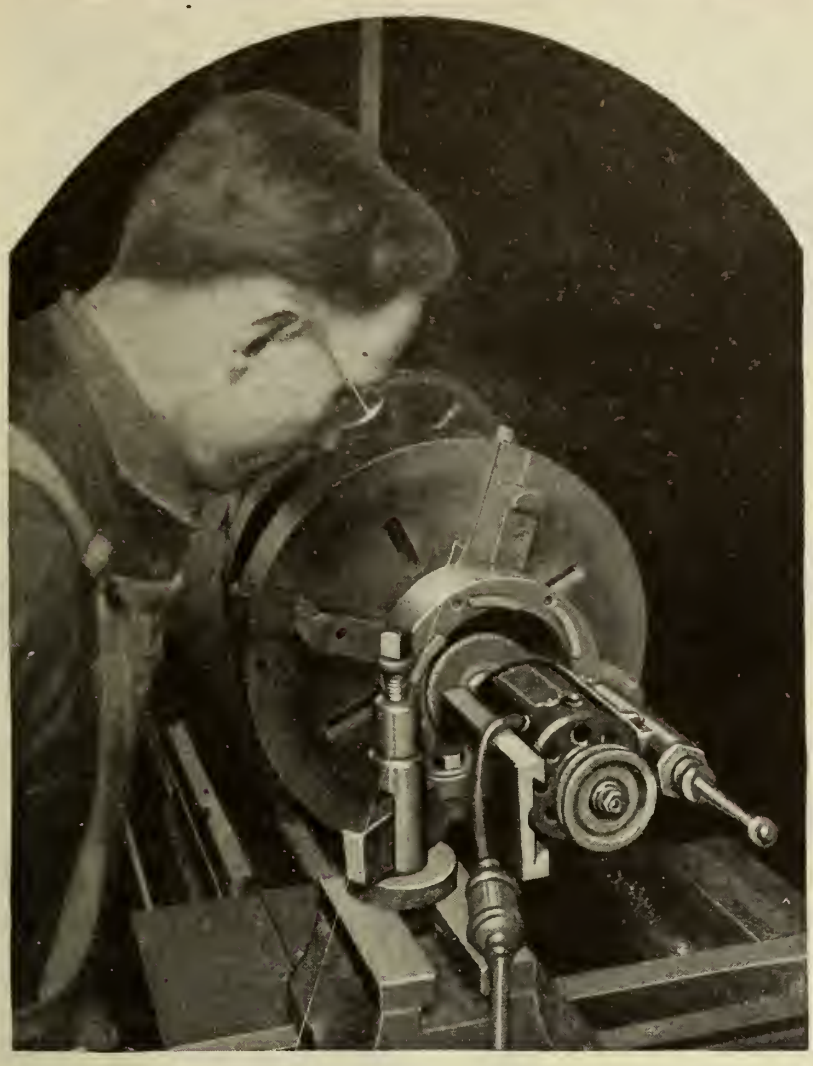
Wire nails, base	$6 10
Cut nails, base	7 00
Miscellaneous wire nails	50%

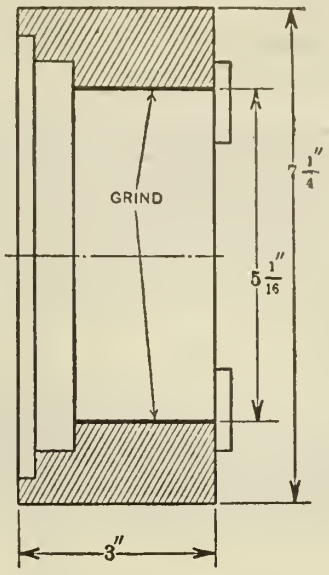
ROPE AND PACKINGS

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net





CAM
FOR DIE HEAD

Attached to the toolpost of the engine lathe on which this cam has been machined, the Dumore Grinder accurately grinds the hole without necessitating another "set up." The high efficiency standards of the Geometric Tool Co. (New Haven Conn.) make comment unnecessary on this method of handling the job. It is sufficient that the work of the Dumore is so satisfactory, the finish so fine, that all cams this size or larger, made in this shop are ground in this manner.

The Average Shop Has Constant Use for Dumore Grinders

Dumore Grinders are made in types and sizes that can be attached to all classes of machines and used to successfully perform a wide variety of grinding operations.

Equally valuable for the important "odd jobs" that must be done in every shop and on some manufacturing work, they find a ready place in every part of every metal working plant—whether toolroom, factory or repair shop.

Ask us about DUMORE Grinders—full details on request.

Wisconsin Electric Company

2930 Sixteenth Street **Racine, Wisconsin**

DUMORE HIGH SPEED GRINDERS

If interested tear out this page and place with letters to be answered.

MISCELLANEOUS

Solder, strictly	$ 0 28½
Solder, guaranteed	0 30½
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	20 35
Red dry lead, 100-lb. kegs, per cwt.	15 00
Gasoline, per gal., bulk	0 42
Pure turp., single bbls., gal.	3 15
Linseed oil, raw, single bbls.	2 37
Linseed oil, boiled, single bbls.	2 40
Wood alcohol, per gal.	4 00
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S.S. drills, wire size	40 and 5
Can. carbon cutters, plus	10
Standard drills, all sizes	40 and 5
3-fluted drills, plus	10
Jobbers' and letter sizes	40 and 5
Bit stock	50
Ratchet drills	10
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers, carbon	50
Centre reamers	5
Chucking reamers	net
Hand reamers	10
High speed drills, list net to plus	20
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7.50 base
Hexagons and flats	7.50 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	70	85
Class B	30	40
Class C	20	30

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 00
Sheets, blue ann., No. 10	7 00	7 50
Canada plates, dull, 52 sheets	13 00	13 00
Can. plates, all bright	14 00	.....
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	13 00	.....
Fleur-de-Lis, 28 B.W.G.	12 50	.....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28	...	....
Premier, No. 28, U.S.	10 00	11 00
Premier, 10¾-oz.	10 50	11 40
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅞ in., $9.20; ¾ in., $9.30; ⅝ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	35 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	29½
Palacine	32½
Machine oil, per gal.	65
Black oil, per gal.	34
Cylinder oil, Capital	1.01
Petroleum fuel oil, bbls., net	19

BELTING—No 1 OAK TANNED

Extra heavy, single and double	6½
Standard	6½
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 30
Brass sheets, 24 gauge and heavier, base	0 38
Brass tubing, seamless	0 42
Copper tubing, seamless	0 44

WASTE

XXX Extra	.23	Atlas	.19
Peerless	.22	X Empire	.18½
Grand	.21½	Ideal	.18
Superior	.21½	X Press	.17
X L C R	.20		

Colored

Lion	.16	Popular	.12
Standard	.14	Keen	.10
No. 1	.14		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.20	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$35 00	$37 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	40 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	43 00	46 00
Copper sheet, planished, 16 oz. base	47 00	50 00
Braziers', in sheets, 6 x 4 base	39 00	42 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 50	$14 50
Sheets, 3½ lbs. sq. ft.	10 25	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 00	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.04¾
Acid, nitric	.11
Acid, sulphuric	.04½
Ammonia, aqua	.15¾
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.16
Copper, carbonate, annhy	.41
Copper, sulphate	.13
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.20
Nickel carbonate	.32
Nickel sulphate	.20
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lbs	9.00
Sodium phosphate	.15
Tin chloride	.30
Zinc chloride, C.P.	.30
Zinc sulphate	.08

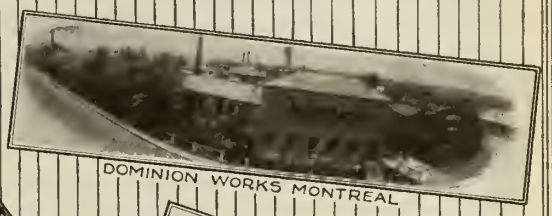
Prices per lb. unless otherwise stated



GENERAL VIEW HAMILTON WORKS



CANADA WORKS HAMILTON

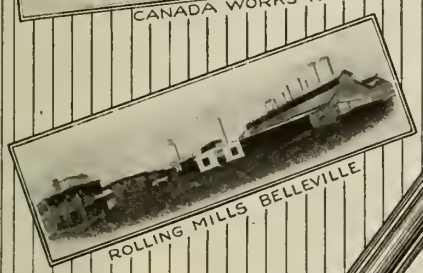


DOMINION WORKS MONTREAL

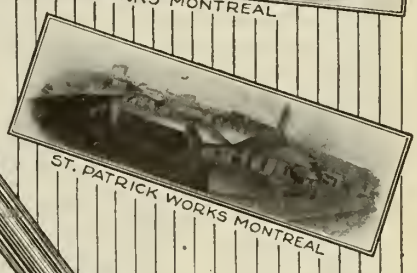
Quality

THE
STEEL COMPANY
OF
CANADA
LIMITED
HAMILTON MONTREAL

Service



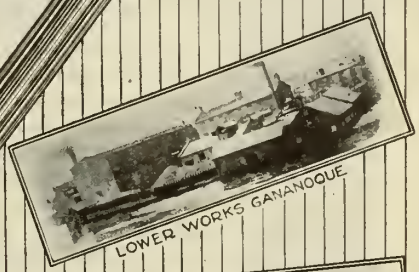
ROLLING MILLS BELLEVILLE



ST. PATRICK WORKS MONTREAL



BRANTFORD WORKS BRANTFORD



LOWER WORKS GANANOQUE



SWANSEA WORKS TORONTO



ST. HENRY WORKS MONTREAL



GENERAL VIEW OF NOTRE DAME WORKS MONTREAL

These Plants and the Organization that directs and operates them, stand back of and Guarantee Quality and Service at All Times

Machine Tool Designers Have Had a Busy Year

Brief Statements Touching on New Developments in Machine Tools and Kindred Lines—Grinders, Presses, Shapers, Planers, Drills, Lathes, and Miscellaneous Tools are Included

DURING the past year many new developments in the machine tool industry have taken place. These developments have been recorded from week to week in Canadian Machinery and the list to follow are only some that we have covered during the year. Of course, greater detail was given than that which follows, but this list is more of a handy reference for our readers rather than a description of the tool itself. Should a reader be interested further, he has merely to drop a line to the firm, in this way securing all the data.

Grinding Machines

The Fitchburg Grinding Machine Company, Pittsburgh, Pa.—A line of plain cylindrical grinding machines. Spindle is of tool steel, and spindle boxes of bronze, these boxes being provided with means of compensation for wear. Automatic cross feed is operated at each reversal of table and is self-releasing when work has been ground to size. These machines are built in six sizes.

The Badger Tool Co., Beloit, Wis.—A new line of grinding machines in which the spindle is fitted with both radial and thrust ball-bearings.

The Grand Rapids Machine Co., Grand Rapids, Mich.—A new line of tap grinding machines for grinding the taper and clearance on the ends of taps.

The Precision and Thread Grinding Mfg. Co., Philadelphia, Pa.—Several grinding attachments that are particularly adapted for thread grinding on lathes. Any style thread can be ground with these attachments. Grinding spindle is carried on ball-bearings, and is adjustable for radial wear and end thrust. Power transmission is accomplished by an endless belt which has a three-point contact with both the driving and driven pulleys. The belt then travels over a compensating two-pulley arrangement, which automatically keeps it at the proper tension to prevent slippage.

The H. F. Harris Engineering Co., Bridgeport, Conn.—An automatic hob grinding machine which embodies various interesting features.

The Lafayette Tool & Equipment Co., Philadelphia, Pa.—A universal grinder for precision tool room work. Both internal and external thread gauge grinding can be performed. The machine can also be used on the bench or as a grinding attachment for lathes, milling machines, shapers, planers, etc., etc.

The National Machine Tool Co., Racine, Wis.—A combination tool cutter and gauge grinding machine. Especially adapted for tool room or machine shop. Will grind cutters, arbors, reamers, mandrils, etc., between centres, or on large or small lathe. This machine can also be used for lapping small dies, bushings, also snap gauges.

The Badger Tool Co., Beloit, Wis.—A new double spindle type disc grinder. This machine is intended for finishing two opposite parallel faces of work at one time, such as drop-forged wrenches, piston rings, nuts, etc.

The Mummert-Dixon Company, Hanover, Pa.—A special design of portable grinding machine. This machine is self-contained and the wheel may be operated at any desired angle without interfering with the general alignment.

The Van Dorn Electric Tool Co., Cleveland, Ohio.—A small aerial grinder, which may be obtained for D.C. or A.C. current. Ball bearings are used throughout.

The Diamond Machine Co., Providence, R.I.—A heavy duty face grinding machine that is intended for grinding operations on heavy equipment that is usually accomplished on planing machines.

The Wordell Manufacturing Co., Cleveland, Ohio.—A new automatic metal cutting circular saw grinder. This machine will re-sharpen all screw-slotting, slitting and cold saws from 1½ inches to 18 inches diameter, and with teeth from 36 to the inch up to 2 inches from point to point. Saws are resharpened at a speed of 45 teeth per minute. The machine is fully automatic and once started requires no further attention.

The Bellevue Industrial Furnace Co., Detroit, Mich.—A line of automatic drill grinders. These grinders are said to sharpen a drill to a perfect angle. The machine is driven by an electric motor in the pedestal and is equipped with two-step pulleys so that two speeds are available.

A. B. Jardine Co., Hespeler, Ont.—A pedestal grinder for general grinding and polishing in machine shop, blacksmith shop, automobile shop, etc.

The Precision Trueing Machine & Tool Co., Cincinnati, Ohio.—A grinding wheel trueing machine. This machine can be applied to any style of grinder and is operated by ei her alternate or direct current.

The Beacon Engineering Co., Tipton, Eng.—A twist drill grinder for drills up to 1¾″, also a sensitive pillar treadle drill for holes up to ½″.

The Bryant Chucking Grinder Co., Springfield, Vt.—A machine for the grinding of holes, also exterior surfaces. The machine is made in two types, single spindle and double.

Various Types of Presses

The Enterprise Machinery Co., Chicago, Ill.—A bench forming press that is intended for the rapid assembling of small parts and for such operations as seaming and riveting on hollow work.

The Lasalle Machine Works, Chicago, Ill.—A line of bench presses designed for accurate production of small parts, such as used by jewelers, typewriter manufacturers and for other kindred work.

The Streine Tool & Mfg. Co., New Bremen, Ohio.—A new toggle forming press for roofing, and special shapes, with a capacity up to 12 ft. in length. This machine is also provided with tables for die work.

The Toledo Machine & Tool Co., Toledo, Ohio.—These people have brought out a considerable number of very large presses during the past year.

Williams & White Co., Moline, Ill.—A new straight side press which has a working length of 16 ft. between the housings and is capable of exerting a pressure of 300 tons distributed load.

The Package Machine Co., Springfield, Mass.—A precision bench lathe on which the headstock is fitted with ball thrust bearings.

Shapers and Planers

The Columbia Machine Tool Co., Hamilton, Ohio.—A varied line of heavy duty shapers ranging from 16″ to 28″ capacity.

The Simmons Machine Co., Albany, N.Y.—An open-side planer that will take work 42 in. wide, 48 in. high and up to 12 ft. in length.

The Turbine Air Tool Co., Cleveland, Ohio.—A line of air planers which are used for shaving telegraph poles and is used on general construction work.

The Oliver Machinery Co., Grand Rapids, Mich.—A new direct-coupled, motor-driven, ball-bearing hand planer and jointer.

Alfred Herbert Co., Ltd., Toronto, are handling a special planer that is known as the Hilo-plane and which is electrically controlled.

The Universal Machine & Tool Co., Canton, Ohio.—A new 24-inch open side planer which is said to combine the



Morrow Drills

Put to the File Test

EVERY Morrow High-Speed Drill is subjected to this rigid test—if it doesn't **"pass"** it is thrown out. There's no guesswork—if the drill isn't up to Morrow Standard you don't get it.

Order by the name.

John Morrow Screw & Nut Co.

LIMITED

Ingersoll, Canada

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489 St. Paul St. W,

WINNIPEG
Confederation Life Building

VANCOUVER
1290 Homer St.

London, Eng.: 7 Hop Exchange, Southwark St.

Send Us Your Blue Prints for Special Screw Machine Parts—Quick Service

If interested tear out this page and place with letters to be answered.

advantages of both shaper and planer. Variable stroke mechanism is used for driving the table, the speed of which is varied by means of shift gears.

Milling Machines

The Garvin Machine Tool Co.—A form miller of horizontal type. This machine is designed for cutting flat or cylindrical cams, and worm gears drive the work arbor. Power is transmitted through spur gearing, three changes of feed being given for the flat cam-cutting fixture. All gearing is housed, protecting it from damage or injury to the operator.

Marshalltown Manufacturing Co., Marshalltown, Iowa.—A plate milling machine for milling the edges of boiler plates. These machines are made in four sizes, having a range from 8 to 24 feet.

Tri State Milling Machine Co., Memphis, Tenn.—A milling machine attachment that has been adapted for use on shaping machines.

The Gabrielson Mfg. Corp., Syracuse, N.Y.—A new manufacturing type of milling machine. These machines are built in three sizes: 6, 9 and 12 inches between the spindle and table.

The Automatic Machine Co., Bridgeport, Conn.—A multiple spindle profile milling machine that is automatic in action. This machine is specially adapted for automobile work.

The Kempsmith Mfg. Co., Milwaukee, Wis.—A new vertical maximiller. This machine is of the usual type, but of very rigid design. Quick power traverse has been arranged, giving 100 inches per minute travel of the table in either direction, and 36 in. per min. on the vertical and transverse movement. The lubrication of the machine has been carefully gone into.

The Taylor & Fenn Co., Hartford, Conn.—A two-spindle spline milling machine that is automatic in operation and designed to simultaneously machine two spline grooves up to six inches in length on opposite sides of the same piece. Two cutters, operating simultaneously, reduce machining time on work where two spline grooves are cut. Work of any diameter up to 5 in. and of any length may be splined. The cutters can be made to advance either in unison or alternately and to knock off in like manner.

The Betts Machine Co., Rochester, N.Y.—A continuous milling machine that can be provided with whatever number of spindles desired.

The Toledo Milling Machine Co., Toledo, Ohio.—A new type of vertical milling machine. Unit construction has been adopted. Longitudinal table movement is 46 in., traverse 14 in. and vertical movement equal to the traverse. The spindle has a vertical movement of 6½ in.

The Ingersoll Milling Machine Co., Rockford, Ill.—A special type of reciprocating milling machine that may be designed to meet specific requirements. These machines are intended for working on duplicate parts.

The Ryerson-Conradson Co., Chicago, Ill.—A new helical drive high power miller. The proportions of this machine are adequate for heavy work, and as already stated, the drive is obtained through helical gears. Change gears are cut from solid, made of chrome nickel steel and are heat treated. Other gears are made of steel or bronze.

The Brown & Sharpe Mfg. Co., Providence, R.I.—A special automatic milling machine which is essentially a manufacturing machine and is used in plants where duplicate work is obtainable.

The Superior & Engineering Co., Detroit—A hand milling machine that is driven by a 1½ h.p. motor. Spindle has 12 changes of speed ranging from 100 to 600 r.p.m.

Various Types of Drills

The Joseph T. Ryerson & Sons, Chicago, Ill.—A new high power, plain, radial drilling machine.

The Arthur C. Mason, Inc., Hawthorne, N. J.—High speed, sensitive, ball-bearing drilling machine. Various features have been incorporated, some of these being elimination of frictional bearings, absence of belt trouble, and direct drive. Machine is equipped with ball-bearings throughout, and all moving parts are protected. Four spindle speeds are arranged for, these varying from three thousand to ten thousand r. p. m. This machine is also made in bench type.

The Arthur C. Mason, Inc., Hamilton, N.J.—A heavy type of sensitive drilling machine. The spindle of this machine is equipped with ball bearings throughout.

National Automatic Tool Co., Richmond, Ind. — An inverted drilling machine which is said to be advantageous for the drilling of deep holes in cast iron.

The Barnes Drill Co., Rockford, Ill.—A gang drill built for heavy duty work. Spindles are exceptionally large and double spindled. This machine will drive a 2-in. twist drill at .041 in. feed per revolution of spindle, or at the rate of 6½ in. per minute in cast iron, without the gears.

The Niles-Bement-Pond Co., N.Y.—A new type of radial drilling machine. This machine is built in two sizes, 5 ft. and 6 ft. arms.

The Sibley Machine Co., South Bend, Ind.—An addition of two sizes to their regular line of drill presses.

Danber Kratsch Co., Oshkosh, Wis.—Upright drill press with all gear feed. Drive for machine consists of semi-steel and rawhide gears. There are no sliding gears in the gear box. Speed may be changed by single movement of clutch lever. Spindle has ball thrust bearings at lower end, and four changes of feed for each spindle speed is provided.

Joseph T. Ryerson and Sons Co., Chicago, Ill.—A high power, radial drilling machine. These machines are made in three sizes, four, five, and six feet arms. Ball bearings are installed.

Hilldrill Co., Philadelphia.—Gang drilling machine. Drill spindles are chain driven, and flexibility of chain drive makes it adaptable for gang drilling on any type of work. The cycle of operations is automatic, and the spacing of spindle is universal. Special mechanism clamps the work in place with a pressure of about ten tons. The drill heads are built as independent, detachable units.

The Morris Machine Tool Co., Cincinnati, Ohio. — Three sizes of radial drills, 2½ ft. 3 ft. and 3½ ft., respectively. Various features have been embodied, and with the exception of large spindle gear, all other gears are made of steel. Gears are fully inclosed and run in light grease or heavy oil. Six feeds are secured. Friction clutches in speed box and tapping attachment are of expanding ring type. Motor drive can be arranged if desired.

Genesee Mfg. Co. Rochester, N.Y.—A special tool for use in drilling machines, for the counter-boring of holes, facing, forming, and similar operations.

Lathes

The Canada Machinery Corp., Galt, Ont.—This concern has brought out a 16-inch by 20-inch shaper and a 42-inch engine lathe. The lathe is equipped with clutch control from the saddle, and an all gear head is driven by motor through silent chain drive. There is an internal gear face drive to the face plate.

R. A. Kelley Co., Xenia, Ohio.—A redesigned shaper which is said to be a considerable improvement over their old design. A special feed box is fitted to the ends of cross rails and feed is automatically disengaged at the end of the travel. Helical teeth are used on all gears and pinions.

Joseph T. Ryerson & Sons, Chicago.—A line of high power selective head engine lathes.

Alfred Herbert, Ltd., Coventry, England.—A universal turret lathe. A heavy duty combination turret machine, and heavy slotter. A new type of hexagon turret lathe that is suitable for both bar and combination turret lathe work. A new hydraulic turret lathe originally in-



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tended for use by disabled men. Chuck turret and cross slide are operated by means of hydraulic cylinders.

The Cincinnati Lathe and Tool Co., Oakley, Cincinnati.—A new line of gear head lathes. Seven sizes are made. These lathes are fitted with hexagon turret on bed, and power feed silent chain drive. As the speed variations are obtainable in the head, constant speed motors only are required. Twelve speed changes in geometric progression are secured on these lathes. This is accomplished through sliding gears and by shifting three levers.

The Seneca Falls Manufacturing Co., Inc., Seneca Falls, N.Y.—Two sizes of gap lathes, eleven inches by eighteen inches, and thirteen by twenty-one inches swing. These machines have wide range for screw cutting of all standard threads, from 3 to 72, including 11½ and 27 pipe threads.

O. R. Adams, Mfg. Co., Rochester, N.Y.—A lathe known as a short cut lathe. The head stock of this machine is designed to give 6 changes of speed with a range from 43 to 375 r.p.m. Speed changes can be made while lathe is in operation.

Miscellaneous Tools

Charles Engelhard, New York.—An automatic temperature regulator that opens or closes control valve at desired temperature.

Canadian Firefoam Co., Hamilton, Canada.—A fire extinguisher known as Foamite Firefoam. Various capacity engines, also small hand tanks are supplied, equipped with this particular extinguishing fluid.

The Ricker Instrument Co., Philadelphia, Pa.—A line of precision levels for machine shop use.

The Independent Pneumatic Tool Co., Chicago.—Pneumatic motor hoists up to two tons capacity, the speed lift is 32, 16 and 8 ft. respectively for the half, one, and two-ton sizes.

The Link-Belt Co., Chicago, Ill. — A new friction clutch which has a one-point adjustment. All moving parts are enclosed and parts are balanced. Parts are easily accessible, if repairs are necessary.

Canadian Reclaimers, Ltd.—A pulpwood reclaimer that is said to eliminate considerable labor when stacking or unstacking pulpwood.

The Pittsburg Instrument and Machine Co., Pittsburgh, Pa.—A sheet metal tester that is used to determine the drawing, stamping, compressive, and folding qualities of sheets of iron, steel, brass, copper, etc., etc.

Link-Belt Co., Chicago.—A hydraulic system for raising or lowering heavy doors such as are used on open hearth and heating furnace work.

The Roberts Mfg. Co., New Haven, Conn.—An improved friction clutch that is adapted to drilling, tapping, and stud setting.

The Kent Machine Co., Kent, Ohio.—A two-spindle pointing machine that is intended for the pointing of bolts, or rods up to three-quarter inch in diameter.

Black & Decker Mfg. Co., Baltimore, Md.—An electric air compressor that is made in two types, namely high and low pressure. The largest of these machines will work up to a pressure of 200 lbs. per square inch.

The Wayne Oil Tank & Pump Co., Fort Wayne, Ind.—An oil filtering cabinet which is intended to be placed under the machine from which the oil is flowing.

The Lapoint Machine Tool Co., Hudson, Mass. — A new type of broaching machine, known as the No. 3 Duplex. The power screws may be operated jointly, or as separate units as desired, and to any required length of broach.

D. MacKenzie Machinery Co., Guelph, Ont.—New saw table. This machine is adapted to electric or gasoline drive, and is designed not only for factories but for manual training schools.

The Scully-Jones, Chicago.—A new drill chuck that is designed to hold a straight shank drill in a taper hole of the drilling machine.

Frank G. Payson Co., Chicago, Ill.—A special line of air operated chucks, for use on double spindle turret lathes.

The Yoder Co., Cleveland, Ohio.—A specially designed slitting shear that is said to remove any irregularities in the strip after it has been cut. On metal up to one-eighth inch in thickness strips as narrow as 2 three-quarters in. may be cut.

The Manhattan Machine and Tool Works, Grand Rapids, Mich.—A four-post screw press that is designed to suit all classes of arbor press work.

The Hoosier Drilling Machine Co., Goshen, Ind. — A new line of machine vises in which the jaws are of hardened steel, but may be modified to meet specific needs.

The Becker Milling Machine Co., Hyde Park, Boston, Mass.—A new machine known as Model D.1 die-sinker. Dies up to ten tons in weight can be accommodated. Centralized control is a feature of this machine. The spindle is back-geared and driven by a five-inch double belt. Thirty-two feeds are obtainable. Fourteen spindle speeds are provided. A seven and a half H. P. variable speed motor is used.

The Atlas Press Co., Kalamazoo, Mich.—Two new arbor presses, one 6-ton capacity, the other 15-ton. These presses are adapted for a variety of work, such as forcing arbors, straightening and broaching operations, etc.

The Cincinnati Gear Cutting Machine Co., Cincinnati, Ohio.—A new type of gear hobbing machine that has a maximum capacity of 17¼ inches diameter and 12-in face.

The Newton Machine Tool Works, Inc., Philadelphia, Pa.—A portable slotting machine that has a maximum stroke of 70 inches.

The Hercules Machine and Tool Co., Astoria, N.Y.—A gear hobbing machine which provides for exhaust adjustment in the centering of the hob. Automatic stops are provided for disengaging the feeds when machining the various classes of gears.

W. J. Pine Machine Co., Kenosha, Wis.—Straightening machine which combines a testing table and machine. Stock to be straightened is placed on upper testing table, then put in position under pressure screw. Operations performed on this machine are: offsetting connecting-rods and bars, bending irregular shapes in forms or dies, etc.

Volta Mfg. Co., Welland.—A furnace of the Heroult type. Furnace transformers have capacity of 1,500 K.V.A., and connection is made to the furnace catenaries by means of the usual copper busses. A tilting arrangement is provided. Furnace is balanced and a small-sized motor gives desired tilt.

The Stock Bridge Machine Co., Worcester, Mass. — A shaper attachment which will shape any irregular curve. Forming dies and various shaped blocks are possible with this attachment. A templet is carried in cross slide holder and is shaped to required outline of surface to be duplicated.

The Foster Machine Co., Elkhart, Ind. — A complete line of hand screw machines embracing five sizes. Several new features are noticed, but on the whole the machines do not represent any radical departure from established practice. Three different styles of cut-off units are supplied, being interchangeable. Power feed to turret is a separate unit, and machine can be built for power or hand feed.

W. S. Rockwell Co., New York.—New type of side-opening heat treating furnace. Furnace is 36 ft. wide, and doors can be raised or lowered independently, operated by compressed air and counter weight. Oil or gas can be used as fuel. Provision is made for convenient control of burners from above the floor level at rear of furnace. Doors are controlled by air hoist mechanism.

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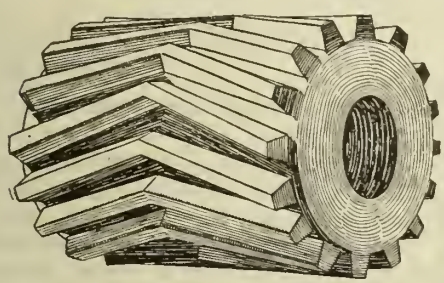
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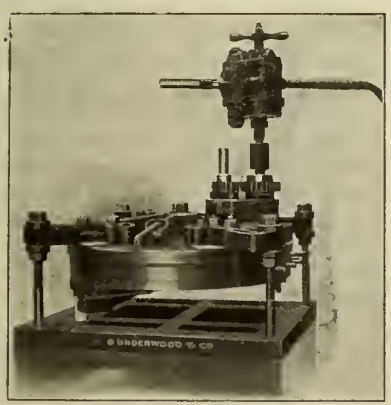
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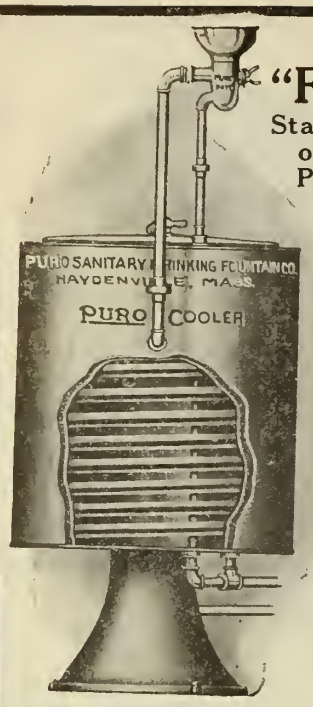
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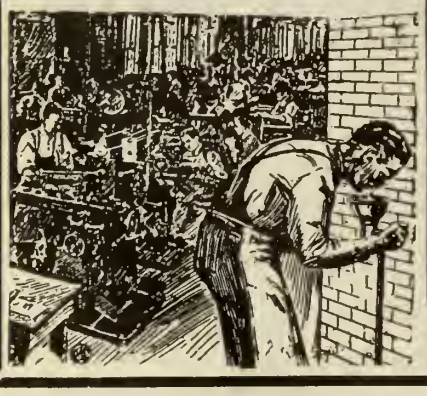
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REFUSE CHANGE ASKED BY N. Y. C.

Step Preferred Instead of Pilot, But Ottawa Does Not See It That Way

OTTAWA.—Application of the New York Central Railway for a modification in the regulations regarding railway safety appliance standards which would permit the company to use step construction instead of pilot construction on its freight engines operating into Canada has been refused by the Board of Railway Commissioners. Dr. S. J. McLean, in refusing the application, states that "the board is asked to allow a departure from its regulations and to allow the substitution therefor of a practice depending entirely on tolerance."

Having in view Canadian conditions and the careful consideration given before the regulations were adopted, he advises refusal of the application.

The Railway Company represented that the step had every advantage that a pilot had, and that its use was allowed under the rules of the Interstate Commerce Commission. The step equipment was not, it was stated, objected to by any of the Public Utilities Commissions of the States through which the New York Central operated, and there would be difficulties in operation if a pilot was required for the portion of the journey in Canada.

PRODUCTION IS UNDER WAR MARK

Figures Given Out Concerning Amount of Iron and Steel Made in Canada

Production of steel and pig iron in Canada in 1920 has shown an increase over 1919, but the figures are considerably below the previous three years, when war contracts so greatly speeded up the output. According to a statement by the Department of Mines at Ottawa, the monthly production of steel in 1920 to the end of September averaged 105,931 tons, compared with the monthly average in the previous four years, as follows: 1919, 86,157; 1918, 156,954; 1917, 145,494; 1916, 106,268.

The monthly production of pig iron this year averaged 89,610 tons for the first nine months, compared with an average of the following in previous years: 1919, 76,482; 1918, 99,629; 1917, 97,540; 1916, 97,438.

The blast furnace plants active during the first nine months were those at Sydney and North Sydney, N.S., Hamilton, Port Colborne and Sault Ste. Marie, Ontario. The blast furnace plants at Midland, Parry Sound, Deseronto and Port Arthur, Ontario, were idle throughout the period. At the end of September ten stacks wer active and eight idle.

Pig iron was made from scrap iron and steel at four electric furnace plants, located at Hull, Montreal and Shawinigan Falls, Quebec, and Orillia, Ontario.

PIG IRON TRADE

That some pig iron users are busy is shown by purchases by rather important companies. Further concessions in price are noted. On the Pittsburg market No. 2 foundry may be obtained at $35 valley furnace. The leading independent steel company in this district has only about one-third of its furnaces making iron at present.

On the Chicago market the absence of transactions of any size makes it difficult to name ruling prices. Southern furnace prices are substantially the same as a week ago.

On the Cleveland market the inquiry is larger than in many weeks, but the volume of sales shows little change. Prices on foundry iron have settled down to $35 base for No. 2. Some producers believe there will be little resale iron on the market after January 1st.

At Boston less resale iron is offered than last week, presumably because of the lack of demand. The feeling among foundry owners is more hopeful, although business is quiet.

The pig iron market at Birmingham is at a standstill as there is practically no business being done. With so many furnaces out, a real buying movement would find very little to go on.

Inquiries are showing improvement, but sales are still light on the Buffalo market. Five hundred tons of resale foundry were sold at $34 to $35 base price per ton. The total inquiries for the week aggregate 3,000 tons, but little of this developed into the actual order stage.

The market is very dull in the Cincinnati district but several inquiries for first half of the year have appeared from outside this territory. Furnace sales continued light, there being no disposition to compete with resale prices on the inquiries appearing.

Iron does not seem to be wanted at any price is reported on the St. Louis market. Furnaces are making no prices, and submission of offers is one of the things more notable by absence than presence in the market.

On the New York market it is extremely difficult to determine prices with any accuracy as reports concerning resales indicate a wide variation in quotations. Several eastern Pennsylvania furnaces are expected to blow out or be banked within the next few days. Eastern Penn. No. 2 foundry 1.75 to 2.25 silicon delivered in New York district is quoted at $36.52 to $37.52.

The Philadelphia market shows further declines in the price of pig iron.

Engineering

Schools are being planned by the Boards of Ste. Apelline, and St. Sylvestre, Que.

The United Farmers of Manitoba, in the district of St. Andrew's, are planning the erection of a hall there.

Victoria Hospital, London, Ont., is to have a new nurses' home. The estimated cost is $100,000. Erection will begin in the spring.

The Pigeon River Lumber Co., Port Arthur, Ont., are rebuilding their planing mill and machinery, destroyed by fire some months ago.

The town of Lauzon, Que., is considering the installation of a new water works system. The estimated cost is about $300,000.

W. Harris and Co. have plans prepared for the erection of a private garage and office building on Keating St., Toronto, at an estimated cost of $25,000.

The Hydro - Electric Commission, Brantford, Ont., is planning to duplicate its system at a cost of $750,000. The new work is projected for the coming year.

Ottawa, Ont., needs a new fire station, and a by-law will be submitted to the property owners at the coming elections to raise the sum of $200,000 for the purpose.

It has recently been announced that the Trans-Canada Theatres, Ltd., are contemplating the erection of theatres at Guelph, Ont., Regina, Sask., and Vancouver, B. C.

The Live Wire Co., Ltd., a new concern in Guelph, Ont., are producing from 30 to 35 thousand feet per day of rubber-covered insulated wire.

The ratepayers, Dutton, Ont., will be called on early in the year to sanction the expenditure of $18,000 for improvements to the community hall on Main street.

Operations are commencing at the new factory of the Canadian Detroit Twist Drill Co., at Walkerville. Their productions will comprise drills, reamers and milling cutters.

Good progress has been made on the 18-storey addition to the King Edward Hotel, Toronto. The steel work of the first 12 storeys is already up and the floors are being put in as the steel work goes up.

A new town is springing up around the paper mills of the Spruce Falls Pulp and Paper Company at Kapuskasing, Ont. There are about 1,250 men at present employed by the mills. Work on the mills is going ahead rapidly and it is expected the first pulpwood unit will be in operation by May next. The sum of $500,000 will be spent on the establishing of this townsite.

The Semet-Solvay Co., the largest concern of its kind in the world, is considering the erection of a by-product coke oven plant in Hamilton, costing $4,000,000. It is said this would produce all the artificial gas necessary to meet Hamilton's needs for several years.

Announcement has been made that plans have so far progressed that preliminary construction work on the international bridge to be built connecting Detroit and Windsor will be started early in the coming summer.

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Write us at once and let us know what you require. Also ask us to place your name on our mailing list to receive a copy of our list of equipment for sale, which we are now getting ready.

We guarantee satisfaction with every machine we sell.

We make a specialty of equipping complete plants, and our engineering service is at your disposal.

R. S. HOLLY

Room 37, 33 Richmond St. W. - - - TORONTO
Phone: Main 4728

International

Railway, Marine and Industrial SUPPLIES

Many years of specializing in Railway, Marine, and Industrial Supplies have rendered our well-organized staff capable of giving prompt, efficient service on all orders. If what you want is not listed here, let us know—we'll have it.

Write, 'phone, or wire your orders

International Supplies Include:

Packing of every description,
Goggles, Industrial and Welding
Screw Jacks
Culver Ball-Bearing Locomotive Jacks
Dayton Pneumatic Tools
Reynolds Oxy-Acetylene Welding and Cutting Torches
Valves, Glove, Angle and Gate
Nathan Locomotive Special and Cutting Torches
Paxton-Mitchell Metallic Packing
Electric Generators and Motors
Electric House Wiring Supplies
Electric Linde-Construction Materials
Electric Power Station Supplies and Apparatus
Electric Heating and Cooking Appliances

International Machinery & Supply Co., Ltd.
421 St. James St., Montreal

NOTICE

On Jan. 1st we are moving to more convenient premises at

77 Adelaide St. W.

No inconvenience will be caused in filling your orders during this change.

THE J. A. M. TAYLOR TOOL CO.

123 Bay St. TORONTO

50½ King St. E. HAMILTON

Representing

The Wilt Twist Drill Co. of Canada, Ltd.
and
The Greenfield Tap & Die Corp. of Canada
LIMITED

BUYING A PIG IN A POKE

The buying of advertising space used to be buying "a pig in a poke." The quantity and quality of circulation was shrouded in mystery and often the bag was tied against investigation.

That day has passed. The advertiser no longer depends upon "mere claims." The Audit Bureau of Circulations has untied the strings to the sack and the circulation of the better class of publications is thrown open for the most searching scrutiny.

In buying advertising space in CANADIAN MACHINERY you are not buying "a pig in a poke." Our A. B. C. statements will stand the analysis of the most exacting investigator.

AGENTS WANTED

For a high grade Piston Packing amongst mill and steamer supply houses in all the principal centres. Sold at a reasonable price, allowing for a good margin of profit to the dealer.



Write for our agent's proposition

Guildford & Sons, Limited

Office and Warehouse:
136-140 Upper Water St.
649-651 Barrington St.

Factory, June St.
HALIFAX, N.S.

MACGOVERN & COMPANY INCORPORATED POWER MACHINERY

STEAM UNITS

3 Phase, 25 Cycle

K.W.	Engine Type Make
42½	WESTINGHOUSE-BUCKEYE
115	WESTINGHOUSE-BUCKEYE
150	WESTINGHOUSE
250	WESTINGHOUSE-McINTOSH SEYMOUR
300	McINTOSH-SEYMOUR
400	WESTINGHOUSE-HAMILTON CORLISS
450	WESTINGHOUSE-McINTOSH SEYMOUR
	Turbo Units
500	WESTINGHOUSE-PARSONS
750	WESTINGHOUSE-PARSONS
850	WESTINGHOUSE-PARSONS
1000	ALLIS CHALMERS-RATTEAU
1250	WESTINGHOUSE-PARSONS
1500	GENERAL ELECTRIC-CURTIS
2500	WESTINGHOUSE
5000	GENERAL ELECTRIC-CURTIS
6500	ALLIS CHALMERS

MacGOVERN & COMPANY, INC.

285 BEAVER HALL HILL, MONTREAL

Offices: New York, Pittsburgh, Seattle. Plants: Lincoln, N.J. and Linden, N.J. Buyers and Sellers of New and Used Machinery

H.W. PETRIE LIMITED

MACHINERY AND SUPPLIES



TORONTO AND HAMILTON

ENGINES
BOILERS
PUMPS
ELECTRIC
MOTORS
ETC.

LATHES
PLANERS
MILLERS
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SHAPERS
BORING
MILLS
DRILL
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HANGERS
SHAFTING
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WOOD
PLANERS
SHAPERS
MATCHERS
SAW TABLES
ETC.

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The House of PETRIE and its Founder

50 Years of Progress



50 Years of Service

THE history of the Metalworking and Woodworking industries of Canada is closely linked with the Machinery and Supply House of H. W. Petrie, Toronto and Hamilton.

When H. W. Petrie entered his chosen field fifty years ago industrial Canada was in its infancy; but it grew and grew, and the house of Petrie grew up with it and became a by-word in every quarter of Canada where Machinery is mentioned During its growth the house of Petrie endured and thrived through periodical trade depressions, politieal upheavals, wars and rumors of wars, for the good reason that a Petrie customer invariably comes back; he learns to expect quality, serviee and a square deal—and he is never disappointed!

It is interesting to note that the house of Petrie was founded at Brantford, Ont., where it had remarkable success. In 1890 the business was transferred to Toronto, where conditions were more in keeping with the rapid growth of the concern.

Commenting upon this the Toronto Globe in its issue of December 27, 1890, referred to Mr. H. W. Petrie as one of the best known dealers of Machinery in the Dominion, who for many years conducted a business in Brantford, and owing to able management and thorough knowledge of the making and handling of machinery found his business had outgrown the confines of Brantford; as a consequence the proprietor found it expedient to remove his plant and erect at a great cost the present commodious depot at Toronto, situated immediately adjoining the tracks of the Canadian Pacific and Grand Trunk Railways.

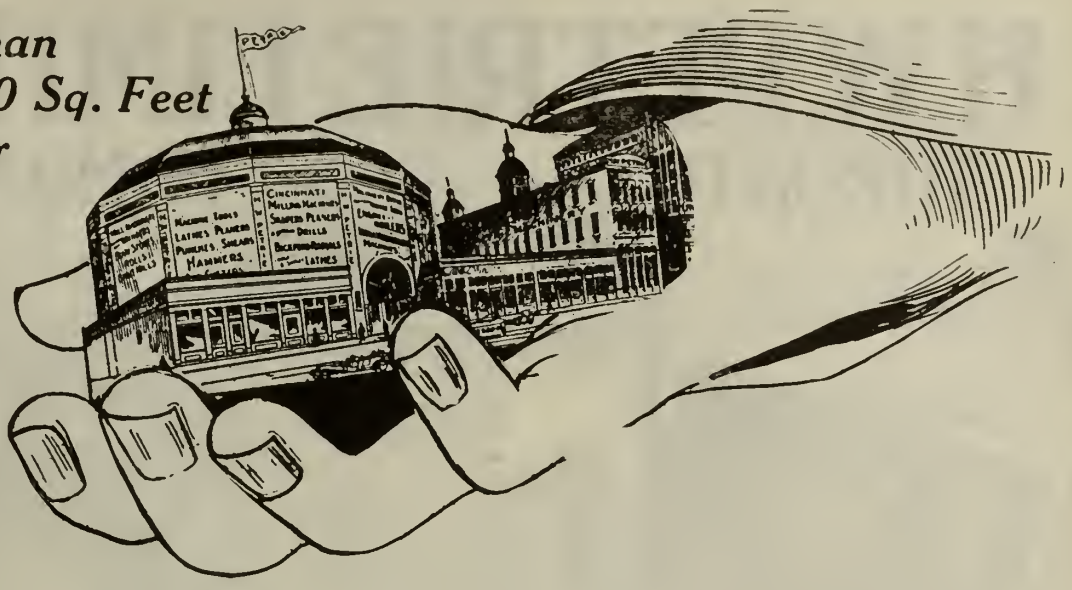
In concluding its remarks the Globe on this occasion said: "This is one of the most extensive machinery establishments on this continent."

What the house of Petrie was to the machinery trade of the Dominion in the early nineties, it remains to-day—Canada's Premier Machinery and Supply House.

H. W. PETRIE LIMITED

TORONTO and HAMILTON

More than 130,000 Sq. Feet of Floor Space



Petrie's Toronto Ware House

Ideal Location Next to Union Station

OUR main warehouse at Toronto is in the heart of the city, next door to the Union Station. We consider ourselves remarkably fortunate in being able to retain a warehouse of such large dimensions in such a convenient spot. Here we have 60,000 feet of floor space devoted to Machine Tools and Supplies for the metal working and woodworking industries.

Then within easy distance of our main warehouse we maintain a large annex at the corner of Bathurst and Niagara Streets. It includes 3¼ acres of yards and 70,000 square feet of warehouse floor space. The floor space in both warehouses thus totals 130,000 square feet.

Our location is of advantage to anyone in Toronto who wishes to inspect our lines, and anybody coming from outside the city is able to step from the train into our main offices and warerooms in two minutes, and it takes but five minutes by car to reach our annex.

You are always welcome at "Petrie's." Give us a call at any time.

H. W. PETRIE LIMITED

TORONTO and HAMILTON

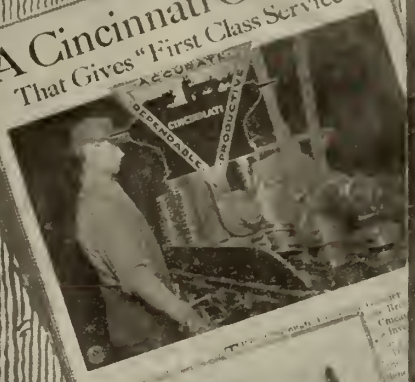
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H.W. PETRIE LIMITED

TORONTO HAMILTON



A Cincinnati Grinder That Gives "First Class Service"



"DALTON SIX"

Type B-4 Actual Swing 7¼ Inches

The Small Lathe for the Big Job



WHY order a large Lathe when so much of your work could be done on a "DALTON SIX" Type B-4

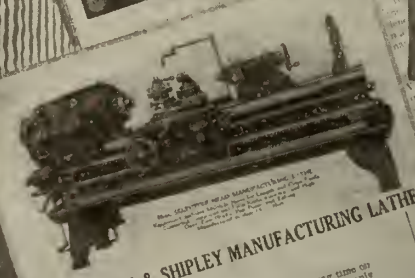
Send for Bulletin

H. W. PETRIE Limited

Toronto Hamilton



Close Standards are Maintained in the Assembly and Inspection of CINCINNATI SHAPERS



THE LODGE & SHIPLEY MANUFACTURING LATHE

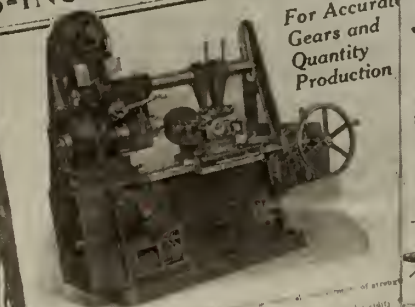
The Cincinnati Automatic Millers May Be the Solution of Your Production Problems



The KEYSTONE to Satisfactory Service is Found in the Use of These Machine Tools ~ Sold by H.W. PETRIE Limited

CINCINNATI 16-INCH GEAR HOBBERS

For Accurate Gears and Quantity Production



The Cincinnati Gear Cutting Machine

CINCINNATI

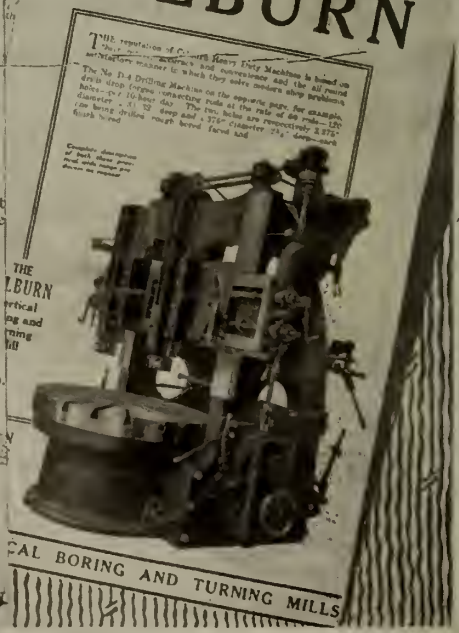


CINCINNATI

24- to 42-inch High Speed Shaft Driven Upright Drilling Machine

The Cincinnati Bickford Tool Co.

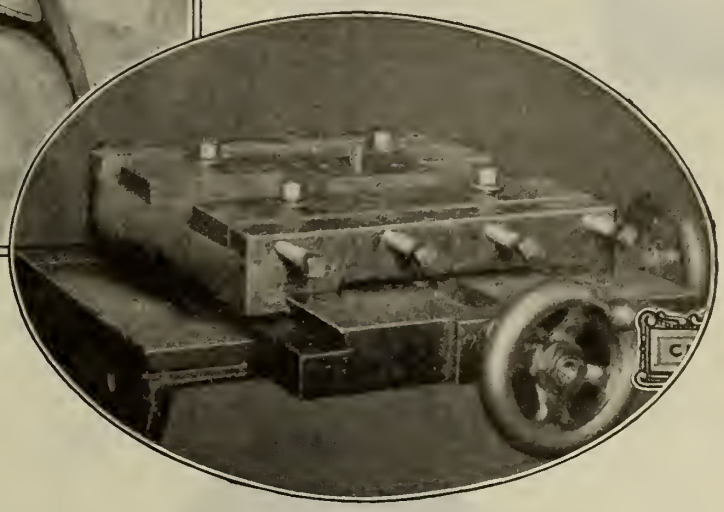
COLBURN



VERTICAL BORING AND TURNING MILLS



A Pioneer Machine for a Pioneer Company



The Pioneer Novelty Manufacturing Company of New York City, among the first companies in its field, found a fitting companion in the

THURCO
Die Milling Machine

a pioneer also. The THURCO DIE MILLING MACHINE was among the first, if not the first, of the machines of its type on the market. For over a quarter of a century it has proved its time and labor saving ability to such an extent that it is to-day *standard equipment* in many die stamping industries.

ONE HOLE ONLY is bored in the die, and the THURCO cuts out the entire shape in ONE PIECE.

MINIMUM FILING is required to finish the die, because, with THURCO'S *flexible* but *positive screw feed,* the shape of the die can be followed with great accuracy.

A circular giving complete information will be sent on request.

We are makers of . THURCO SAWS and THURCO FILING MACHINES

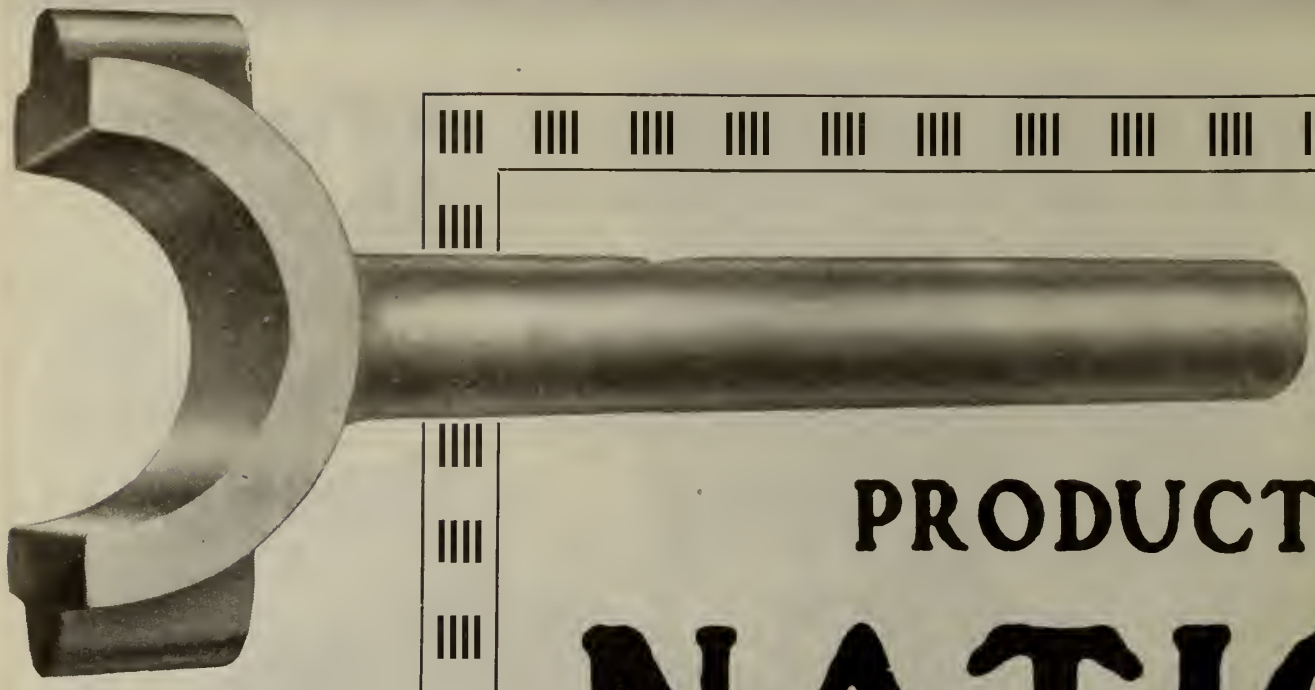
THURSTON MANUFACTURING CO., Providence, R.I.

Canadian Representative:

H. W. PETRIE, LIMITED

TORONTO, CANADA

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PRODUCTS

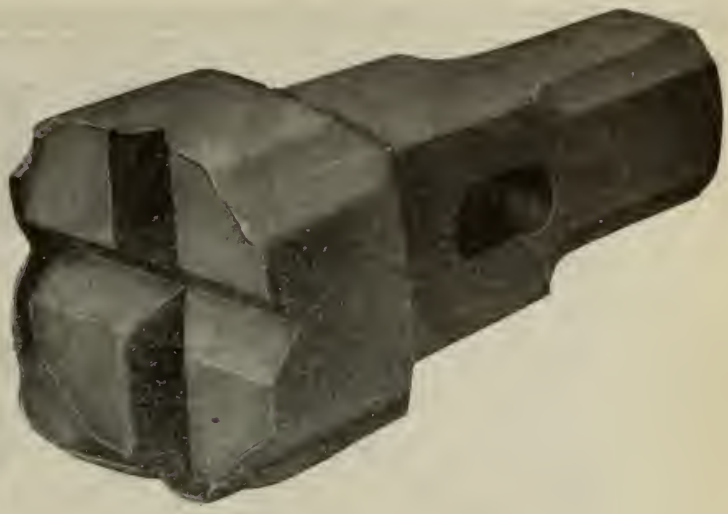
NATIO

HEAVY-
FORGING
(STEEL



The National Machinery
Tiffin, Ohio, U.S.A.

Canadian Representatives:
H. W. PETRIE, LTD.



OF THE

NAL

PATTERN MACHINES

BED)

Co.

MONTREAL
TORONTO

Forgings produced in the National Heavy-Pattern (All Steel) Forging Machine are exceptionally free from fins and flash.

The heavy under-slung steel bed frame; the means provided for maintaining slide alignment; and the all around massiveness and rigidity of the National makes for sounder and better finished forgings.

Submit your forging problems to us for solution.



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MORROW

SCREWS, NUTS, STUDS

Quality and Quick Service

Oldest and largest producers in Canada of Set Screws, Cap Screws, Semi-finished Nuts, and Engine Studs. Also makers of Special Screw Machine Parts. Long experience and extensive equipment enables us to give you superior quality and service.

Let us know your requirements and we will quote you.

John Morrow Screw & Nut Co.
LIMITED

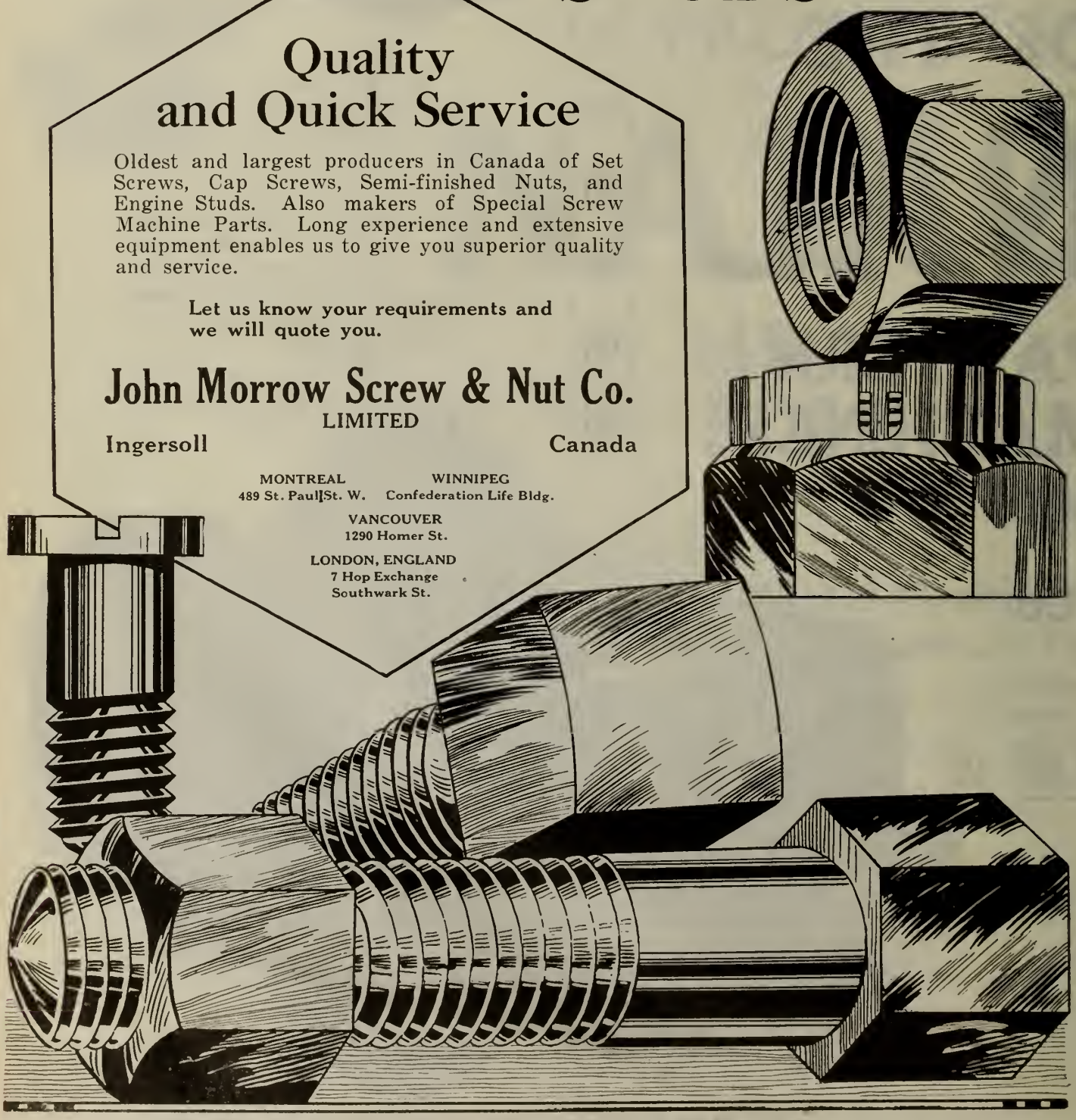
Ingersoll Canada

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Confederation Life Bldg.

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It Will Pay You to

DIAGRAPH YOUR SHIPMENTS

For Speed— and Insurance Against Loss

A **DIAGRAPH** machine is the cheapest insurance you can buy against lost shipments. The rough abuse acquired through numerous transferring calls for an address that can not be torn or rubbed off through contact. **Diagraph Machines** make permanent, legible stencil markings—a positive insurance against loss. That's why nearly 20,000 shippers in practically every line of business use **Diagraphs** for cutting stencils to address boxes, barrels, bales, crates, stock bins, castings, machine parts, etc.

And then there's the matter of speed. Are you going to let your shipping clerk mark one box by hand in the time that he could address four or five with a Diagraph Stencil? The Diagraph cuts 100 to 120 addresses an hour—about 900 a day—equal to or greater than the speed requirements of the largest shippers in the world.

Transportation Service Limited

46 Colborne St., Toronto, Ont.

REPRESENTING

DIAGRAPH STENCIL MACHINE CORPORATION

Sole Manufacturers

ST. LOUIS, U.S.A.

Let us send our illustrated catalogue



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SaBeN ExTrA
HIGH SPEED STEEL

The Highest Achievement
of British Tool Steel
Metallurgy



H. A. DRURY COMPANY LIMITED STEEL

MONTREAL TORONTO NEW YORK
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Tycos
TEMPERATURE INSTRUMENTS
INDICATING-RECORDING-CONTROLLING

Whatever the specific demand for a temperature instrument, indicating, recording, controlling—somewhere in the broad range of the Tycos line is one that meets it exactly.

Angle and Straight Stem Thermometers
Indicating and Recording Thermometers
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Request catalogs and details of application to your problems.

Taylor Instrument Companies
ROCHESTER, N.Y.
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There's a Tycos or Taylor Temperature Instrument for Every Purpose

Tycos

Steel Fingers Slip into The Flutes



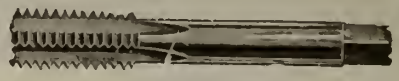
Grip the broken tap and back it out before you've had time to count three times sixty.

The Walton Tap Extractor

removes broken taps buried below the surface of the work without trouble or loss of time. It removes any broken tap without injuring the thread. It saves the casting or forging. Pays for itself over and over—often on the very first job.

How many do you want on trial?

The Walton Co.
Hartford - - - Conn.



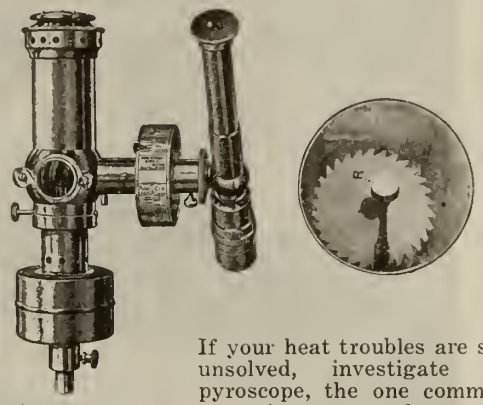
Have You a Scleroscope to Test Your Metals?

FOR SOFTNESS, HARDNESS OR STRENGTH

THE PYROSCOPE

OPTICAL PYROMETER





Testing a Gear for Hardness (Scleroscope on Swing Arm)

Can be operated by non-technical help. The majority of manufacturers are thus ordering their material to specifications, as to quality and fitness, meaning that the minority who have not a scleroscope to inspect their material may have to accept the discard of their more up-to-date competitors. It shows if you are getting what you pay for out of your tool steels. Send for our 80-page booklet. Free.

If your heat troubles are still unsolved, investigate the pyroscope, the one common-sense instrument that makes straight for results without fuss. Extreme simplicity—constancy — always ready. Pamphlet on request.

Shore Instrument & Mfg. Co., Inc., 555-557 W. 22nd St., New York

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Patent No. 200576

Ridsdale Reinforced Bearings

Every user and manufacturer of Machinery a prospective buyer, also

Railway Companies. Electric Motor Manufacturers. Automobile Manufacturers.

Costs less and gives superior service to any Babbitt made.

We also manufacture—

Special Machinery, Tools, Pressure Tanks, Machine Vise.

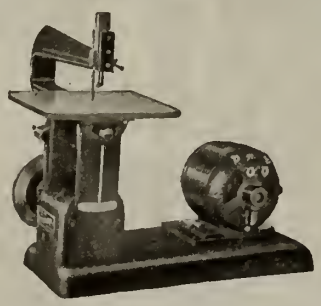
The Lang Manufacturing Co., Ltd.

GUELPH, ONT., CANADA



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THE
Oliver of Adrian

For sawing, filing, lapping, keyseating, screw-slotting, and many other operations.

Turning Out Work in One-Half to One-Third the Usual Time

The making of dies, templets and gauges by hand is a slow, tedious, costly operation.

Why stick to this old method of tool making when you can get a machine that will do **better** work in a **fraction** of the time?

The above illustration shows two diemakers at work, one sawing and the other filing dies in the plant of the Robbins & Myers Co., Brantford, Canada. To them, as well as such firms as Brown & Sharpe, Cadillac Motor Co., Studebaker Corp., Ford Motor Co., General Electric Co., Winchester Repeating Arms Co., and thousands of other users, the **Oliver** is daily demonstrating its ability as a great time, labor, and money saver.

Our catalog tells the story. It shows how you can save much of your present die-making costs. Shows all models and describes fully the work they do. **Write for it now.**

OLIVER INSTRUMENT CO.,
ADRIAN, MICH.

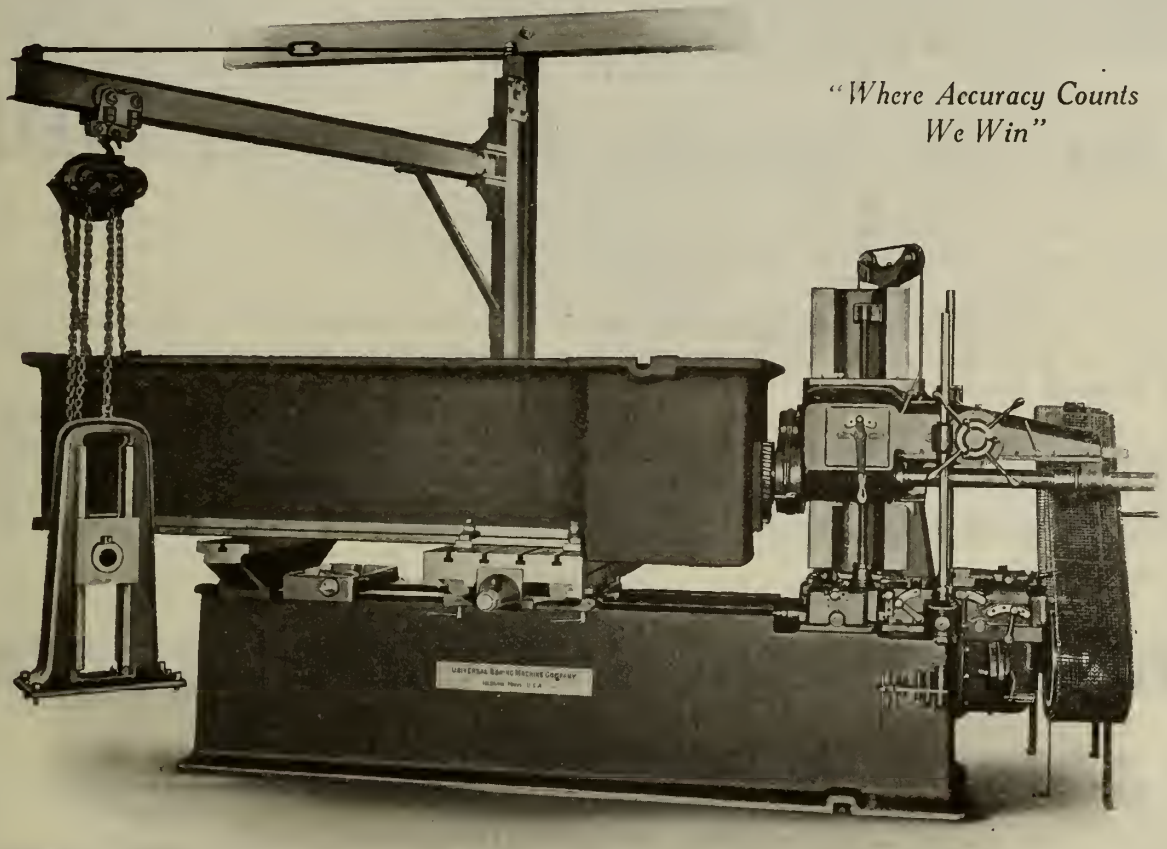
Universal (Horizontal) Boring Machine

Designed for

BORING, DRILLING, MILLING and FACING

Tool Room! Production! Railroad Shop!

That's why it's Universal



"Where Accuracy Counts We Win"

Our Auxiliary Table supporting overhang work. This is our own bed, weighing 4,100 lbs. on our No. 3-A and 5,000 on our No. 3½ Universal.

Our new method of removing our rear post from machine. Simply loosen four screws, which can be done in a moment. Base remaining on bed insures continual contact between scraped surfaces.

UNIVERSAL BORING MACHINE CO. Hudson, Mass., U.S.A.

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Winnipeg Vancouver

H. W. PETRIE LTD., 4 King St., Hamilton

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"No Time Recorders for me--my employees are on piece work"

This man stands in his own light!

The man who says: "No Time Recorders for me—I don't need them—my employees are on piece work," has no real appreciation of what goes to make up his costs.

He is like some others from whom we get a similar answer when we introduce International Time Recorders to manufacturers. Had he kept abreast of the times he would know, as other manufacturers know, that it is in piece work plants that Time Recording Systems are scoring some of their biggest successes.

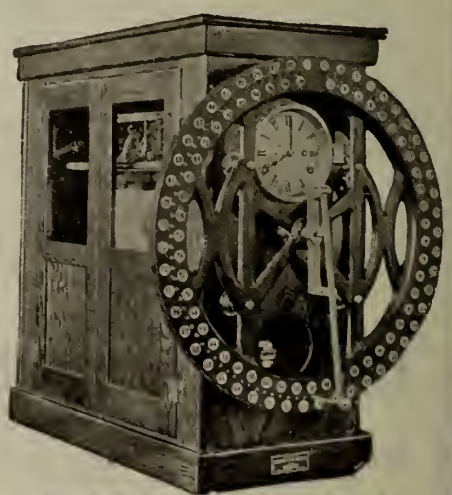
The employees' earnings are only a part of production costs. There is interest on capital and equipment, and depreciation to figure. There is factory "burden expense," such as power, light, taxes, heat, repairs, etc. There is the lost time of other employees depending on the work that should have been done by the absentees. And how can you arrive at even "piece work rates" without an absolutely accurate, legible record of hours worked?

International Time Recorders

Then the loss through inferior workmanship caused by piece workers coming late and scamping their work to get enough done—"seconds," damages materials, tools, etc. Doesn't this all cost money? It does. The remedy is the use of International Time Recorders which ensure punctuality and promote factory discipline. International Time Recorders ensure that you get every minute of working time you pay for. Every employee keeps his own time record and knows it is absolutely just and unchangeable.

For bigger production even with a smaller force use International Time Recorders.

Let us send you our latest circular.



New Fully Automatic Dial Time Recorder

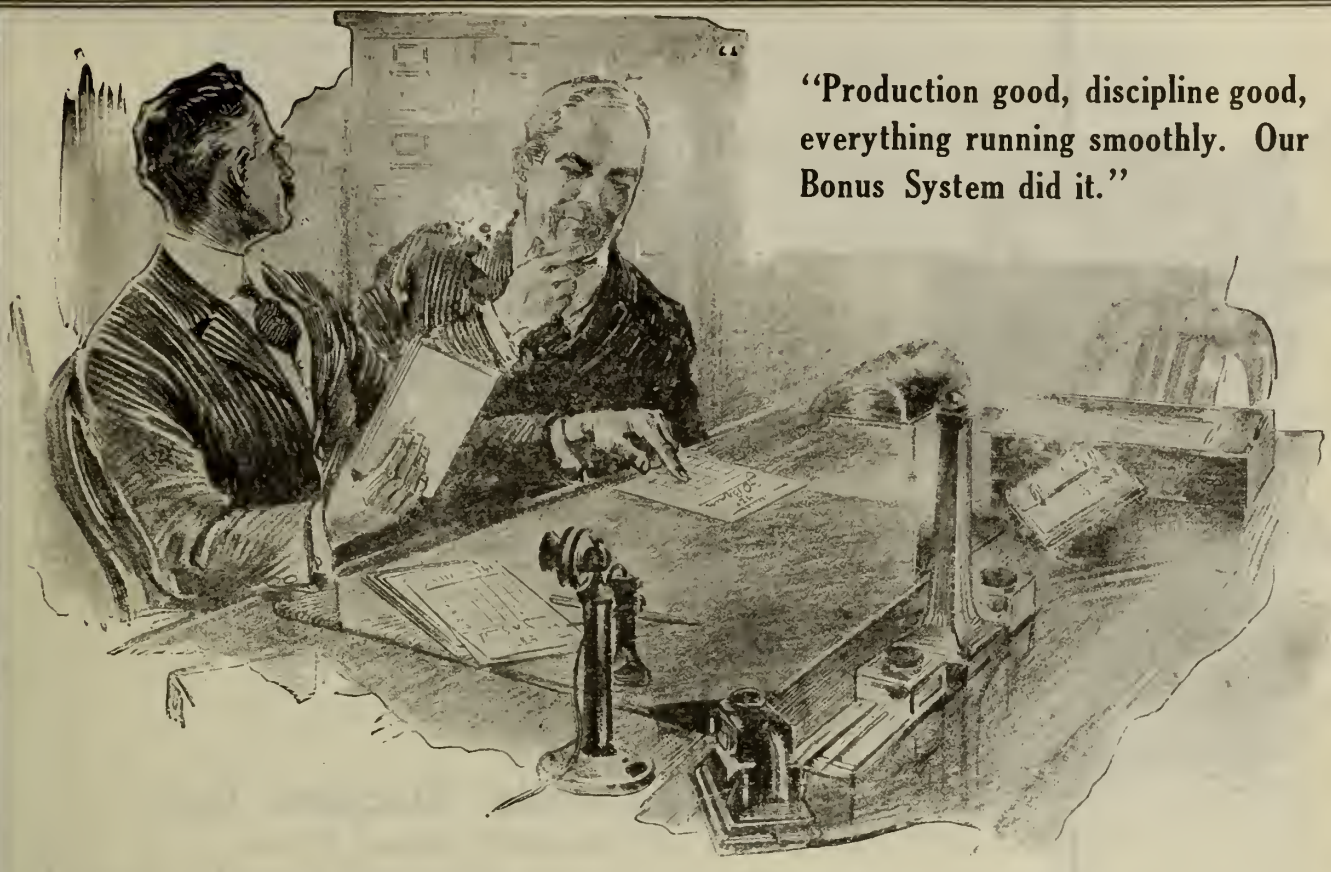
International Business Machines Co., Limited

F. E. MUTTON, Vice-President and General Manager

Head Office and Factory, 300-350 Campbell Avenue, Toronto

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Also manufacturers of International Dayton Scales and International Electric Tabulators and Sorters



"Production good, discipline good, everything running smoothly. Our Bonus System did it."

TIME is the heart, base and root of All Bonus Systems

A Bonus System will work wonders in connection with improving your output, keeping down overhead, getting full value from peak power loads, and in promoting discipline, contentment, and loyalty. It is doing this for hundreds of other firms, why not for you, too? In order to control the basic element of all bonus systems, which is TIME, you should use

International Time Recorders

An International makes every man his own time keeper. The time records are accurate, unchangeable—yet impersonal and impartial. Its constant urge to punctuality and discipline will cut down the daily total of lost working minutes that so often run into the hundreds of thousands and increase the overhead expense. Our Job Time Recorders take care of piece-work operations. Our In-and-Out Dial or Card Records insure punctuality at the daily shifts.

Send for our latest printed matter.

International Business Machines Co. Limited

F. E. MUTTON, Vice-President and General Manager

Head Office and Factory, 300-350 Campbell Avenue, Toronto

HALIFAX 44 Granville St.	ST. JOHN 18 Germain St.	QUEBEC 501 Merger Bldg.	LONDON 489 Richmond St.
OTTAWA 190 Queen St.	TORONTO 409½ Yonge St.	HAMILTON 228 King St. E.	
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Greenfield

Trade-Mark Reg. U.S. Pat. Office

Plain Grinders

will greatly cut the cost of your small cylindrical work within the limits of 4 x 12 inches. Equipped with small grinding wheels for taking light cuts with great rapidity, they require only a minimum amount of power.

Greenfield Plain Grinders are strong, accurate, medium-weight machines capable of giving any degree of speed without shifting belt or changing gears. They grind small standardized parts with efficiency and dispatch.

It will prove worth your while to investigate their many other money-saving features. Write to-day for particulars of this money-saving grinder.

Greenfield Machine Co.
Greenfield, Mass., U.S.A.



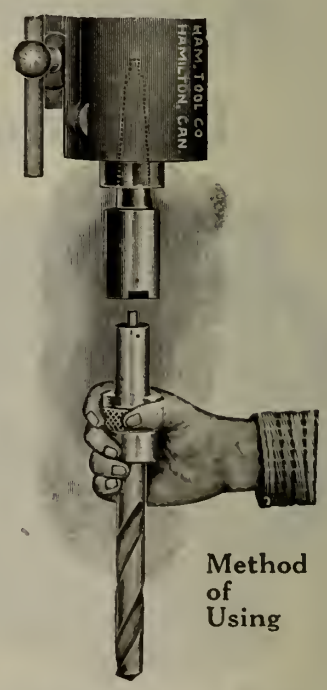
THE BEAVER CHUCK AND COLLET

A Real Time-Saver!

With the Beaver Chuck and Collet you can interchange your drills, reamers, counterbores, etc., **without stopping the machine!** The change is made easily, with the use of hammer, wrench or key. One hand is enough! A self-contained device releases collet and tool instantly.

The Beaver Chuck and Collet converts a single spindle into what is practically a multiple spindle machine. Think of the time you will save! As many tools on one machine as you have operations on any piece of work.

Write for full particulars.



Method of Using

The Hamilton Tool Co., Limited, Hamilton, Ont.

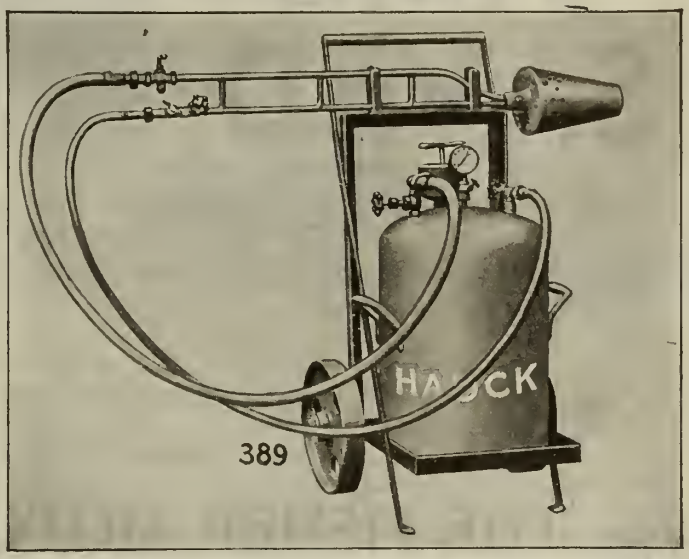


Hauck Burners

Light Instantly, Without Preheating

Illustrated on the right is the Hauck Compressed Air Type Burner. This outfit burns the cheapest grade of crude fuel, kerosene oil or distillate, with compressed air at any pressure from 20 to 100 pounds—**and requires no preheating.**

Built for everyday hard use, these burners are practically indestructible, though extremely light in weight. Flames are steady and easily regulated to any size.



Canadian Hauck Burner Co., Ltd.
PORT HOPE, ONT.

Hauck Burners are made in designs for every requirement of the machine shop, the foundry, the power plant and in special designs for individual requirements.. Our Bulletin No. 112 contains complete information; shall we mail you a copy?

TRADE MARK

MAGNOLIA ANTIFRICTION METAL

TRADE MARK

New Truths and Old Fallacies

Fusibility of Alloys—*Continued*

One of the best illustrations that we can give of the effect of frictional heat is shown in the test of Magnolia Metal in comparison with a dozen or more of the best known brands of Genuine Babbitt.

This test was made by Dr. Torrey (deceased), then chief Assayer of the United States Mint at New York.

The Magnolia test block was run for eighty minutes with variable loads up to 2,000 pounds per square inch, 1,600 R. P. M. on 5-inch shaft.

Not one of the Genuine Babbitts came within measurable distance of Magnolia, as they ran out in from five to fifteen minutes at loads of 500 to 1,000 pounds per square inch—one reaching 1,400 pounds, but failing in ten minutes. The failure of the Genuine Babbitts was not from lack of quality, but simply because the frictional heat could not be prevented from reaching a destructive temperature, although tested on the same machine and under the same conditions as Magnolia.

Some of these Genuines might have been slightly harder than Magnolia, and Magnolia would have squashed in exactly the same way under the same low stress, had not its self-lubricating quality kept the temperature from rising beyond a safe limit.

At moderate speeds and pressures these Genuines might never have given such evidence of their deficiency, and would have been credited with being as good, if not better, than Magnolia.

This Magnolia quality, as exemplified by this test, shows the saving grace of a low frictional co-efficient and also the futility of mere hardness to save a metal from squashing.

(Continued next month)

For copy of complete article:
"New Truths and Old Fallacies"
Address our Montreal Office

Sold by Leading Dealers Everywhere or by

Magnolia Metal Co. of Canada

Office and Factory:
37-39 Shannon Street, Montreal, Que.

If interested tear out this page and place with letters to be answered.

Die-Castings Require No Machining

Think of the

TIME SAVED



Die-Castings as an aid to maximum production cannot be beaten. They are strong, uniform, quickly made, **and require no machining!** The die-casting as it leaves the die is in a finished condition. It comes to you bright and true, all ready for assembling.

Investigate the possibilities of die-castings on **your** work. Don't say your parts are too complicated until you get our opinion.

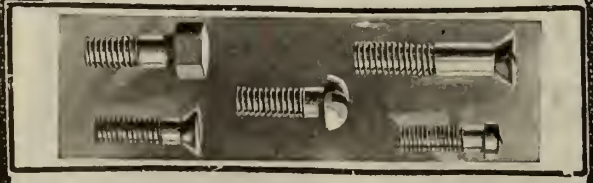
Largest Makers of Die-Castings in Canada

THE FISHER MOTOR CO., LIMITED

ORILLIA, ONTARIO

Wood Screw Making Machinery

SEND FOR CATALOGUE
Series

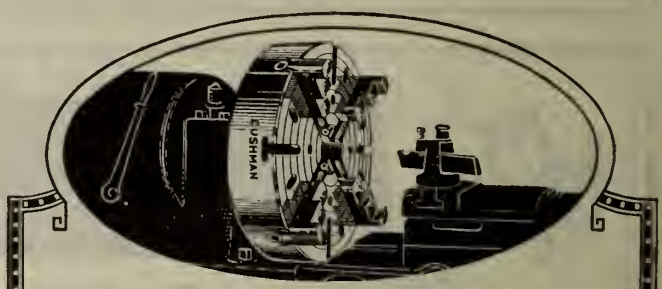


For sixty years we have constantly manufactured machinery for making screws, always studying to improve and refine our product.

Write or Wire us.

Cable address: "Cook,"
Hartford, U.S.A.
Codes: Liebers
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Asa S. Cook Co.
Hartford, Conn.



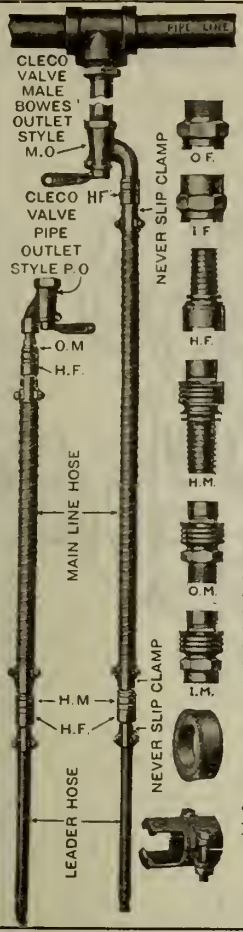
FOR THE BUSINESS END OF YOUR LATHES

"CUSHMAN" CHUCKS
1862

ARE YOU GETTING THE DRIVING POWER OUT OF YOUR MACHINES WHICH THEY ARE RATED TO PULL? EQUIPPING YOUR MACHINES WITH CUSHMAN CHUCKS IS A BUSINESS PROPOSITION. THEY WILL DELIVER MAXIMUM POWER---THEY WILL SATISFY AND PLEASE THE MOST EXACTING WORKMAN.

THE CUSHMAN CHUCK CO. HARTFORD, CONN., U.S.A.

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.



Cleco Pressure-Seated Air Valves

Bowes Air Hose Couplings—Cleco Never Slip Hose Clamps and Cleco Grooved Hose Nipples and Hose Clamp Tool

STYLE O.F. is an Outside Thread Female Pipe End. Made in sizes ⅜-inch to 1½-inch.

STYLE I.F. is an Inside Thread Female Pipe End. Made in sizes ¼-inch to 1½-inch.

STYLE H.F. is a Female Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼-inch to 1½-inch.

STYLE H.M. is a Male Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼-inch to 1½-inch.

STYLE O.M. is an Inside Thread Male Pipe End. Made in sizes ¼-inch to 1½-inch.

STYLE I.M. is an Inside Thread Male Pipe End. Made in sizes ⅜-inch to 1½-inch.

The Male and Female Ends of Bowes Couplings interchange in sizes ¼-inch to ¾-inch. Sizes 1-inch and 1¼-inch interchange. The 1½-inch ends interchange only with themselves.

BOWES COUPLINGS

Are instantly connected or disconnected.
They are absolutely air-tight under all pressures.
They quickly pay for themselves by stopping costly leaks.
They interchange in sizes most commonly used.
They have no loose parts to be mislaid or lost.
They are made of brass and will not rust.
The U-shaped Gasket interchanges in couplings ¼-inch to ¾-inch.

CLECO VALVES



Style P.O. Style M.O. Style A.

Style P.O.—Made in sizes ¼ in., ⅜ in., ½ in., ¾ in., 1 in., 1¼ in., 1½ in., 1¾ in., and 2 in. Pipe Outlets. Inlets are one pipe size larger.
Style A—30° Angle Valves, are made in sizes ½ in., and ¾ in.
Style M.O. Valve—Has 1 in. Inlet and Bowes Coupling Outlet, Connects with Bowes sizes ¼ in. to ¾ in.

CLECO GROOVED HOSE NIPPLES



Grooved Nipples when attached to the Hose with Wire Clamps as illustrated cannot "blow out." Wire clamp tool shown below applies the wires to hose.



The Lightening Hose Clamp Tool illustrated applies wire clamps at a cost of 1½ cents each.

In stock: Riveting and Chipping Hammers, Air Drills, Emery Grinders, Sand Rammers, etc.

Use Annealed Wire No. 14

IMPORTANT:—The Small Leaks in your "AIR LINE" mean serious loss in DOLLARS. Have you any idea of the amount of "Air" wasted in small leaks at your connections? Air Leakage through 1-16 in. opening equals 5.32 cu. ft. per minute at 80 lbs. It will pay you to install Bowes Couplings and Cleco Valves, which will stop costly leaks.

Bulletins Nos. 43, 44, 46 and 47 mailed on request.

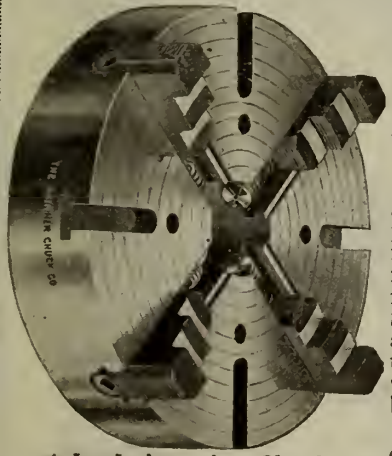
THE MODEL HOSE LINE illustrated shows correct styles of couplings and valve to use and proper way to attach the Cleco Never Slip Hose Clamps to Bowes Couplings. No "blow-offs" can occur when "Cleco" Clamps are used.

CLEVELAND PNEUMATIC TOOL CO. OF CANADA, LIMITED

84 Chestnut St., TORONTO, ONT. 337 Craig St. W., MONTREAL, QUE.

Strong Chucks—

That truly describes Skinner Steel Body Independent Lathe Chucks. They are not only strong and powerful, but wonderfully accurate. The



4-Jaw Independent Chuck, Steel Body, for Heavy Duty

SKINNER Steel Body Independent Lathe Chuck

is a single steel casting of great strength, well proportioned and accurately finished. Face is graduated accurately in inches. Screws and bearings are made of the toughest steel to withstand abnormally hard wear.

The dependability of Skinner Steel Body Independent Lathe Chucks is conclusively proved by the fact that not one has ever been known to break in service—and we have been making them for many years.

Write for catalogue and illustrated literature.

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NEW BRITAIN, CONN U S A
ESTABLISHED 1887

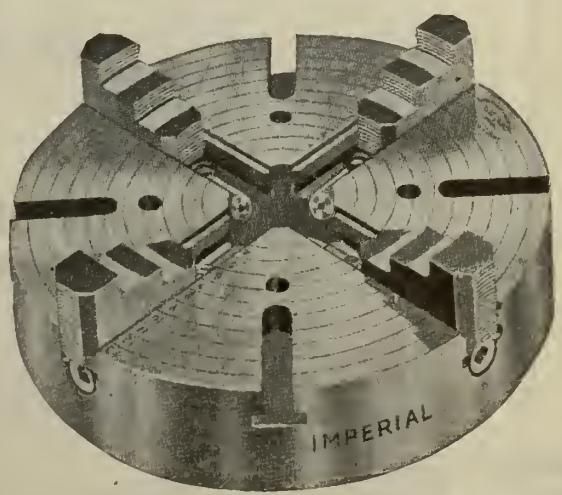
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Highly Endorsed by Canada's Best Manufacturers

Sturdy long-wearing "Made-in-Canada" Chucks that are making good everywhere.

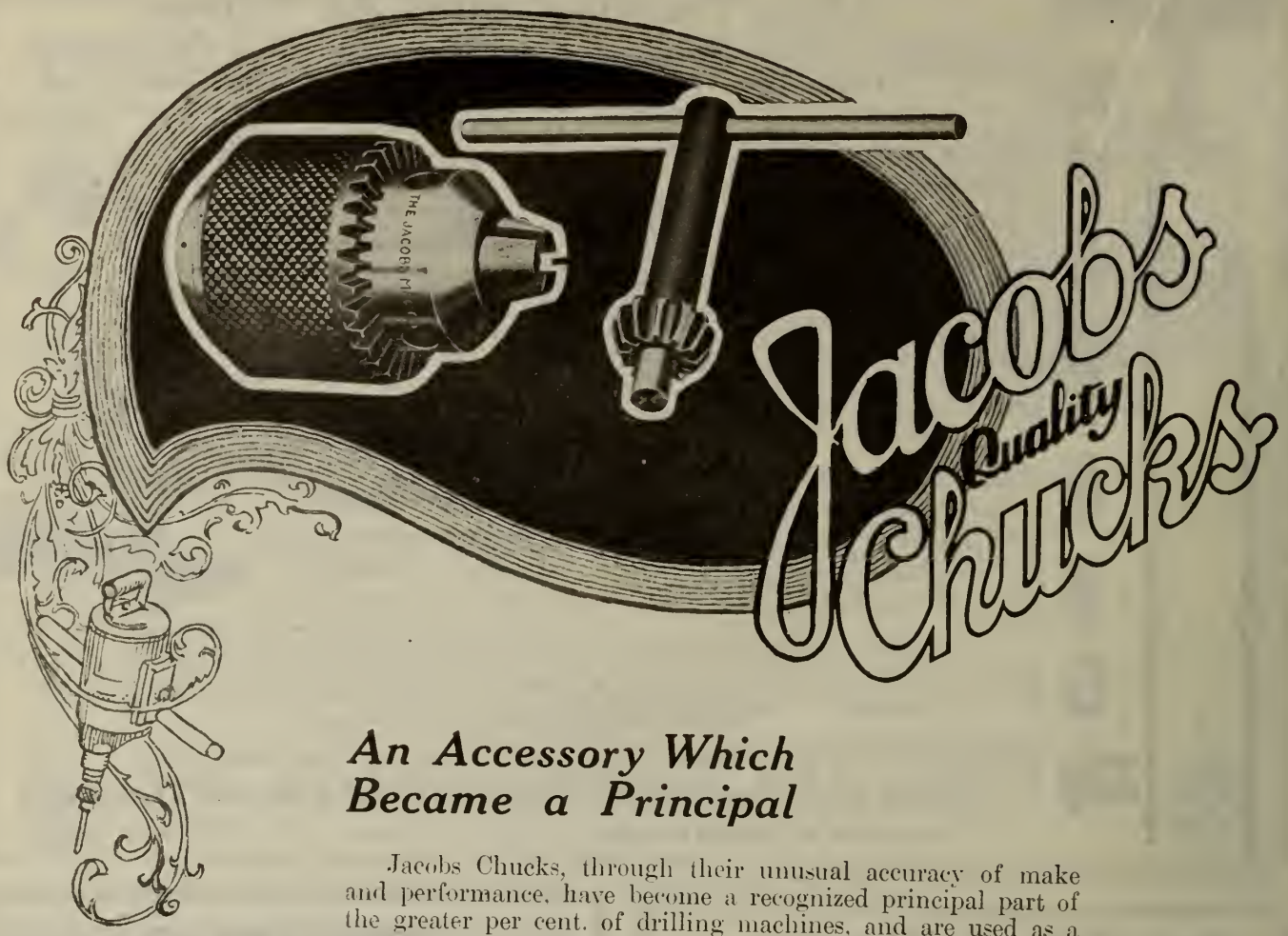
Specify them in your next order.



Ker & Goodwin Machinery Co. LIMITED

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An Accessory Which Became a Principal

Jacobs Chucks, through their unusual accuracy of make and performance, have become a recognized principal part of the greater per cent. of drilling machines, and are used as a strong talking point by manufacturers, equippers, jobbers, and users alike.

Are you availing yourself of their super strength, durability, and accuracy?



The Jacobs Manufacturing Company
Hartford, Conn., U.S.A.

For Sale by The Canadian Fairbanks-Morse Company Limited

FAIRBANKS-MORSE QUALITY F M 100 p.c.

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Ryerson Machinery-Service

Ryerson Machinery-Service includes a complete line of machinery, comprising everything for the boiler, structural, bridge, railway and general machine shop, such as Punches, Shears, Bending Rolls, Lathes, Planers, Shapers, Milling Machines, Drill Presses, etc.

There are also many other remarkable labor-saving machines which we have developed during the last few years, including our High Speed Friction Saws, Steel Frame Combination Punching and Shearing Machines, and the Ryerson-Conradson line of machine tools.

We are always pleased to furnish prices and further information on all Ryerson Machinery. A bulletin on any particular machine or a complete catalogue on all Ryerson Machines will be mailed at your request.

A strong staff of experienced engineers is always available for consultation.

JOSEPH T. RYERSON & SON

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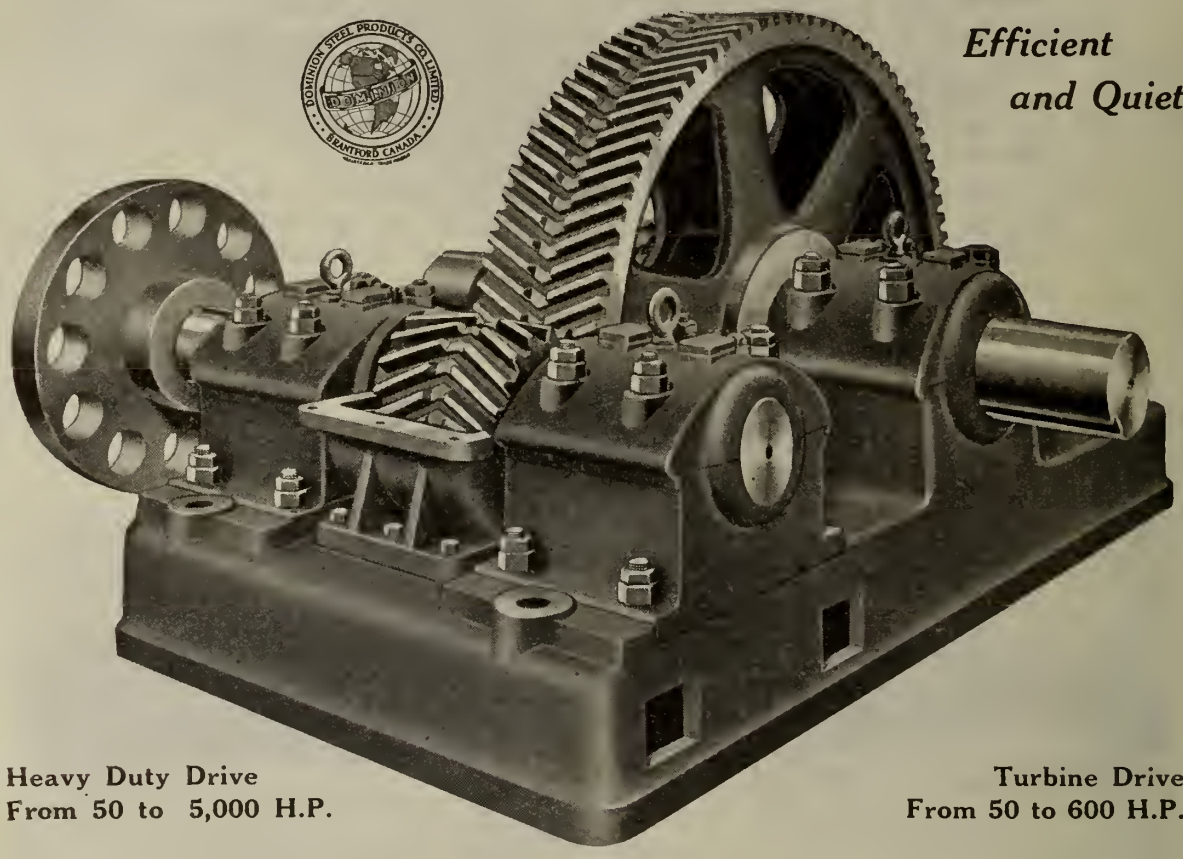
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Efficient and Quiet



Heavy Duty Drive
From 50 to 5,000 H.P.

Turbine Drive
From 50 to 600 H.P.

Turbine Reduction Gear Drive for Steam Turbines, Pumps, etc.

CUT GEARS—Standard and Special

Designers and Manufacturers of

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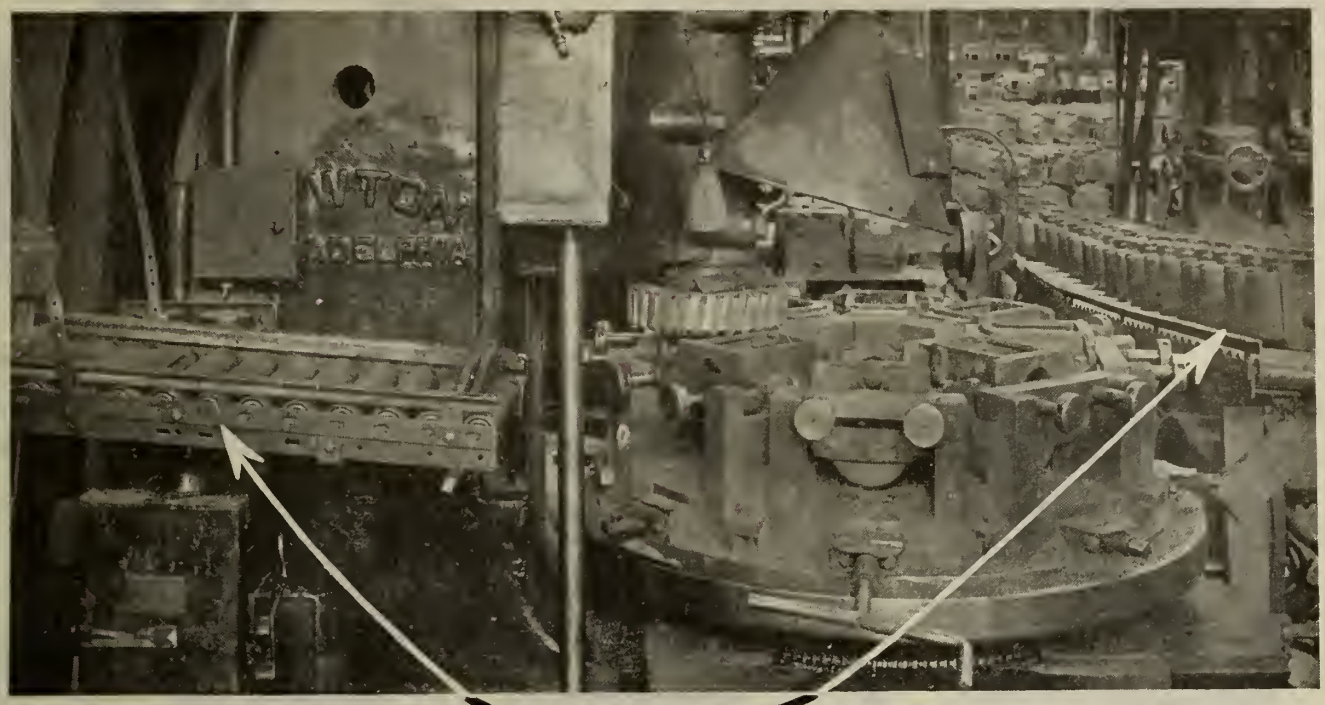
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DOMINION STEEL PRODUCTS CO., LIMITED

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MATHEWS GRAVITY CONVEYOR

A Necessary Aid to Efficiency

Labor is one of the most expensive items of modern shop operation. Any device which will tend to reduce the amount of labor you require, merits your careful consideration.

Mathews Gravity Conveyor is just such a device. The cost of every bit of work requiring operations by more than one machine costs considerably more than is necessary to produce, if the piece must be trucked or carried by hand from one machine to another. Eliminate the labor expense of transportation and the cost of each piece is appreciably reduced.

Install Mathews Gravity Conveyors. They will solve the problem of transporting your pieces. They will take the work from machine to machine for nothing—gravity does the work!

It will be worth your while—ask us for full particulars. Drop us a line to-day!

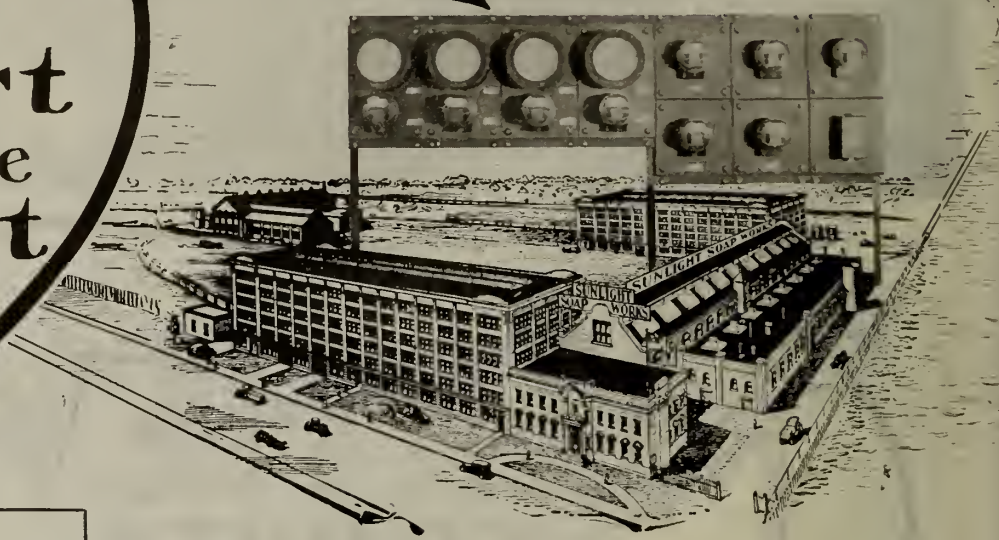
Mathews Gravity Carrier Company, Limited
Port Hope, Ontario

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Republic

Flow Meters and

The Heart of the Plant



The Results Secured by this Large British Firm by the Use of

REPUBLIC FLOW METERS

Can be Secured by You

Read the two testimonials herewith. Then tell us how Republic Flow Meters will conform to your plant conditions and save time, worry and expense.

Less Fuel Consumed

The Republic Flow Meters Co., of Canada, Limited, October 12th, 1920.
145 Wellington St. West, Toronto.

Dear Sirs,—We wrote you some time ago, shortly after your Meters were installed, advising that we were getting good results. The installation is now complete and we have many good figures to work with.

We have located leakages of steam which it would have been impossible to discover without the use of your Meters.

Our fuel consumption is being reduced daily and we hope by the end of the year to have yet more complete and lasting results.

The Meters paid for themselves the first week they were in operation.

We would be glad to furnish particulars to any of your customers who may require information.

Yours very truly,
LEVER BROTHERS, LIMITED,
(Signed) James Mess, Works Superintendent.

One Boiler Less Needed

The Republic Flow Meters Co., of Canada, Limited, October 1st, 1920.
145 Wellington St. West, Toronto.

Gentlemen,—In reply to yours of the 29th enquiring as to the results we have had from Republic Flow Meters, I beg to state that since we have had the meters in operation I have been enabled to cut one boiler from use, and also by discovering leaks in lines, I have been able to carry over the week ends with one boiler instead of two as formerly.

We have been able to make great progress with the conservation of fuel by the application of the meters, and I am convinced that a plant without them cannot be economically run.

I shall be glad to show any person you may refer to me the charts, and prove to them the indispensable value of Flow Meters.

Yours truly,
LEVER BROTHERS, LIMITED,
(Signed) Wm. S. Ball, Power Engineer.

Republic Flow Meters Company of Canada, Limited

Eastern Representative:
The Mason Regulator & Engineering Co., Limited
185 Dagenais St., MONTREAL

Republic System

145 Wellington Street West
TORONTO

Republic

CO_2 Recorders

Point Out the Path to

Systematic Saving



THE Republic Flow Meter points out the path to systematic saving and tells you what your conditions are in the boiler room, the engine room, and in every department where steam is used.

It is a constant guide to saving, and, once the habit of saving has been acquired, the amount of savings is practically unlimited.

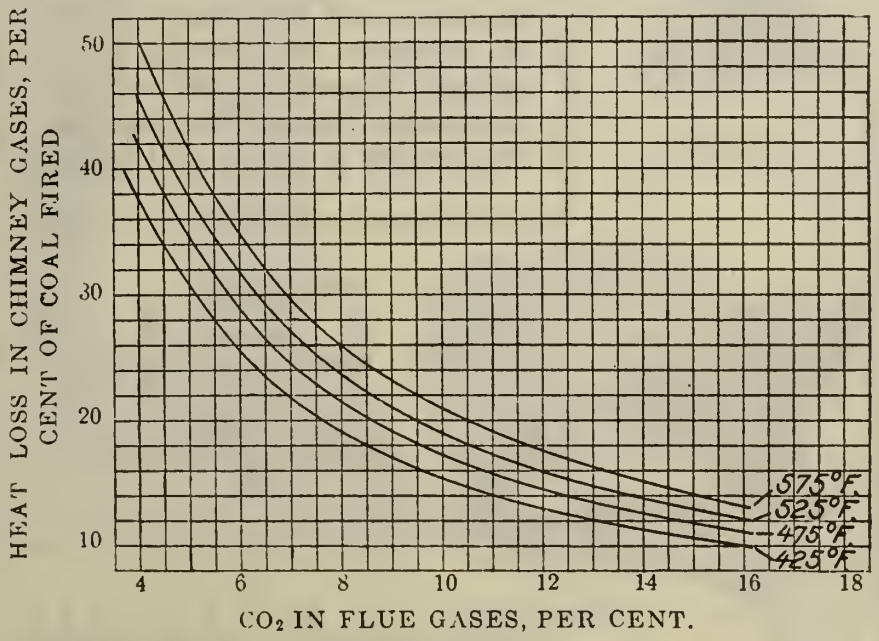
The Republic CO_2 Recorder has been developed to operate continuously under all boiler room conditions, the objectionable features found in all other CO_2 recorders having been eliminated. This enables the operator to observe the conditions of combustion at all times and to obtain the highest efficiency from his furnace—which means less work, less fuel, and less expense.

THE chart shown here demonstrates the relation between the percentage of CO_2 in the flue gases and the heat losses through the smokestack, showing the importance of observing and recording the CO_2 contents in the flue gases.

These curves were prepared by the Bureau of Mines at Washington, and we believe that they are absolutely reliable; the most up-to-date and exhaustive that it is possible to find.

By a reference to this chart it will be seen how the reduction of CO_2 shows the tremendous wastes that are going on in every plant to-day.

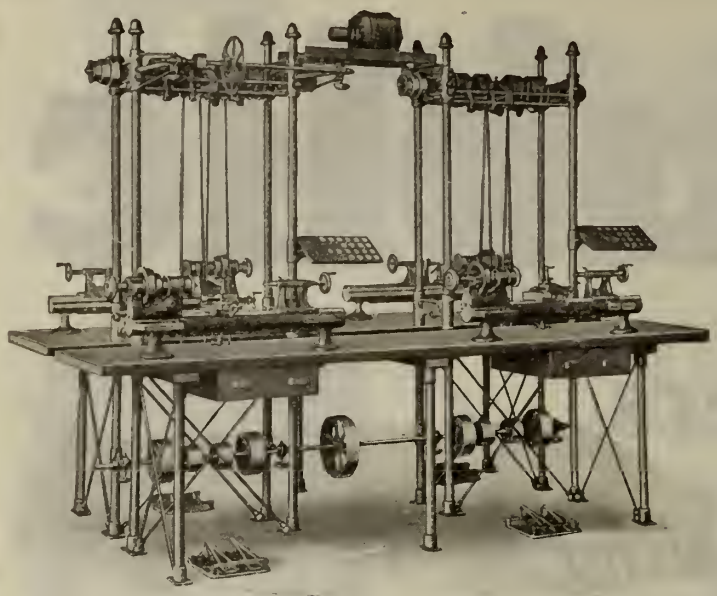
What is your percentage of CO_2? If you do not know, then you should know. If you do know, then refer to this chart, find out what your percentage of waste is, and the result, we feel sure, will be that the average CO_2 carried in your plant will be increased at once. Investigate Republic CO_2 Recorders now!



Republic Flow Meters Company of Canada, Limited

Eastern Representative:
The Mason Regulator & Engineering Co., Limited
185 Dagenais St., MONTREAL

145 Wellington Street West
TORONTO



Cataract R-4 Double Bench Unit with Under-Drive.
(Details in No. 15 Catalogue.)

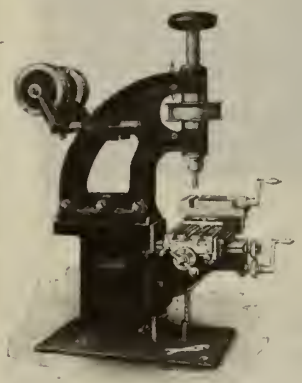
The equipment shown to the left being self-contained, is particularly well adapted for tool room work, or manufacturing of duplicate parts both in first and second operations.



Cataract Quick Change Swing Precision Lathe, with Motor Drive.
(Special Catalogue for Details.)

CATARACT
MACHINE TOOLS

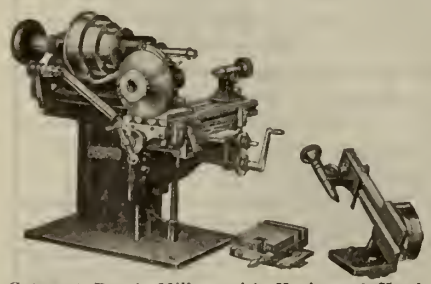
Best quality material, first-class workmanship, unexcelled finish, accuracy and interchangeability of fixtures that really interchange—these are the features that make Cataract Machines the first choice of the careful buyer.



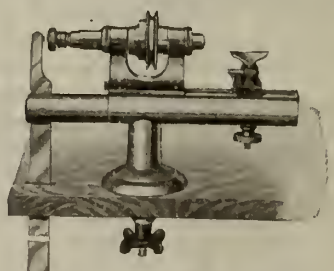
Cataract Bench Miller, with Vertical Head.
Details in No. 5 Catalogue.



Cataract Quick Change Swing Precision Lathe, with Cone Drive.
(Details in Special Catalogue.)



Cataract Bench Miller, with Horizontal Head.
(Details in No. 15 Catalogue.)



Cataract Filing and Polishing Head, with Lever Chuck Operating Device.



Cataract Bench Lathe with Turret Double Tool Cross Slide and Chuck Closer for the Manufacture of Duplicate Parts.

Our Special Catalogue No. 15 contains full details and specifications of these and other Cataract Tools. Write for it now.

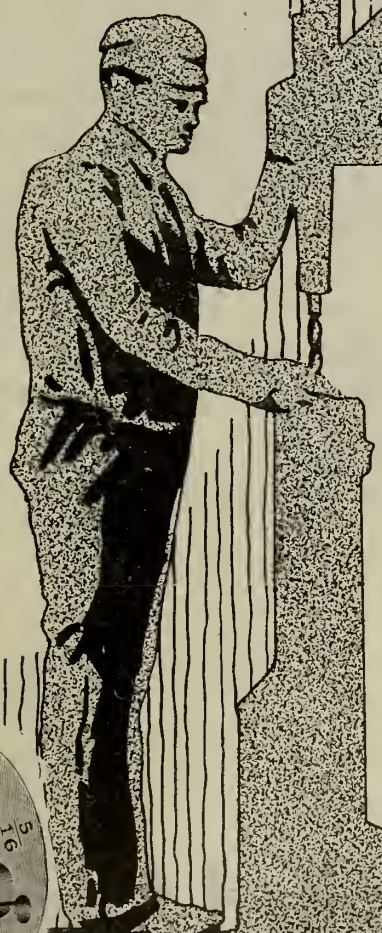
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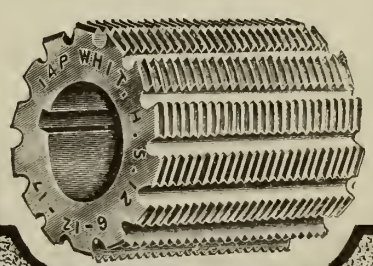
Taps
Dies
and
Screw
Plates



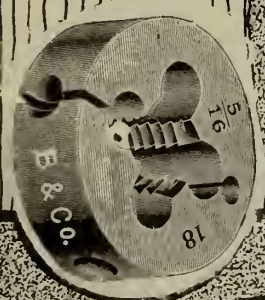
WHEN you order *Butterfield* tools you can depend upon the *quality*. They come to you ready to give long, hard, economical service.

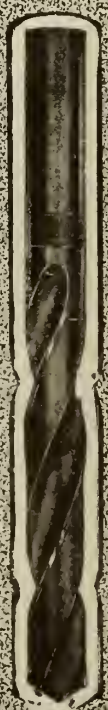
They are made by expert workmen from specially selected material and before leaving the factory are thoroughly tested to prove they are made according to the *Butterfield* standard of efficiency.

Give them a trial









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Molybdenum Steels

"MOLY"
Our Trade Name for Chrome-Molybdenum Steel

The publicity being given to Molybdenum as an alloying element for commercial steels is pleasing to us in that it serves to direct attention to a very meritorious alloy steel.

The first Molybdenum Steel made in the United States in commercial quantities was produced in our open hearth and electric furnaces. We have made more Molybdenum Steel than any other alloy steel manufacturer in the world.

Our success in making Molybdenum Steels is undoubtedly due to our long specialization in alloy steel manufacture.

United Alloy Steel Corporation Canton Ohio

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Open Hearth and Electric Furnace

Chrome-Vanadium
Nickel—3½% and 5%
Chrome-Molybdenum
Chrome-Nickel
Carbon-Chrome
High Carbon-Special
Nickel-Chrome-Vanadium
Nickel-Chrome-Molybdenum

Our Steels are Melted—Rolled—Annealed—Heat Treated—Cold Drawn—in one large plant, and under supervision of Alloy Steel experts.

Our experience has been gained by specialization in the production of Alloy Steels.

UNITED ALLOY STEEL CORPORATION

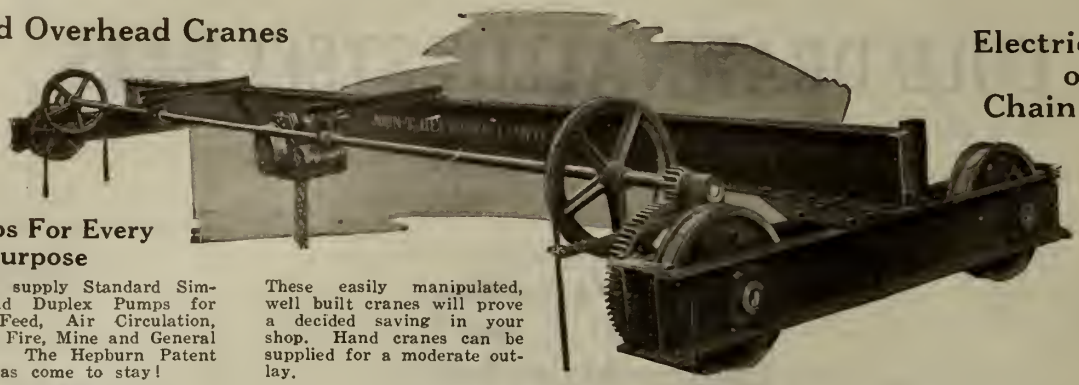
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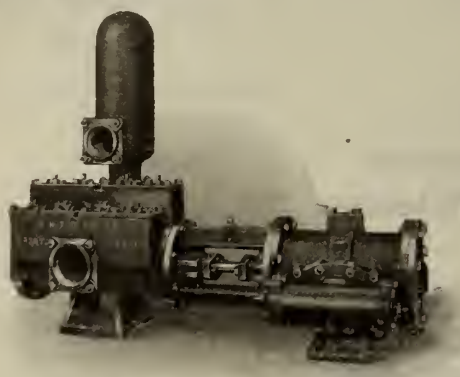


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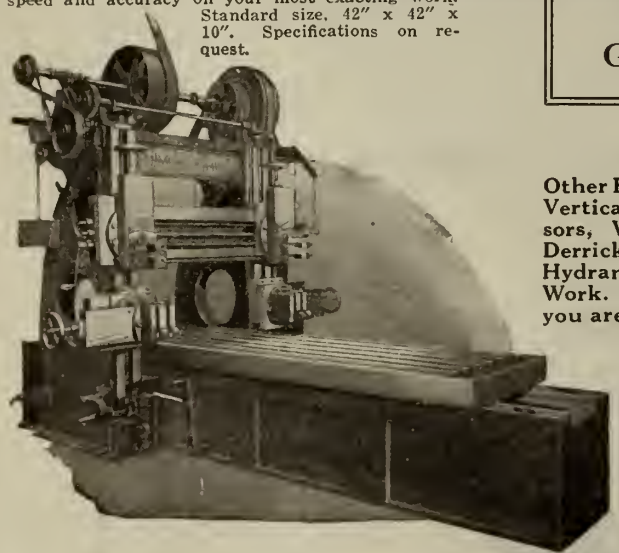
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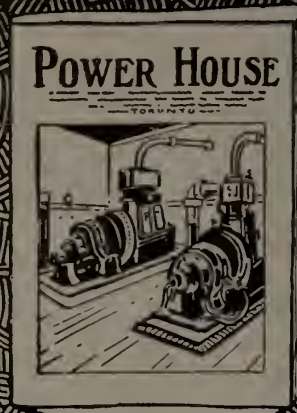
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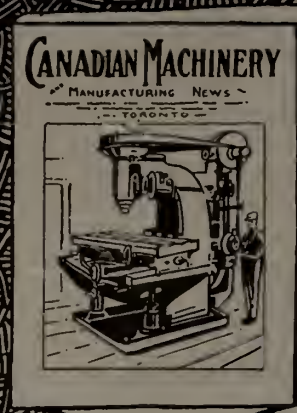
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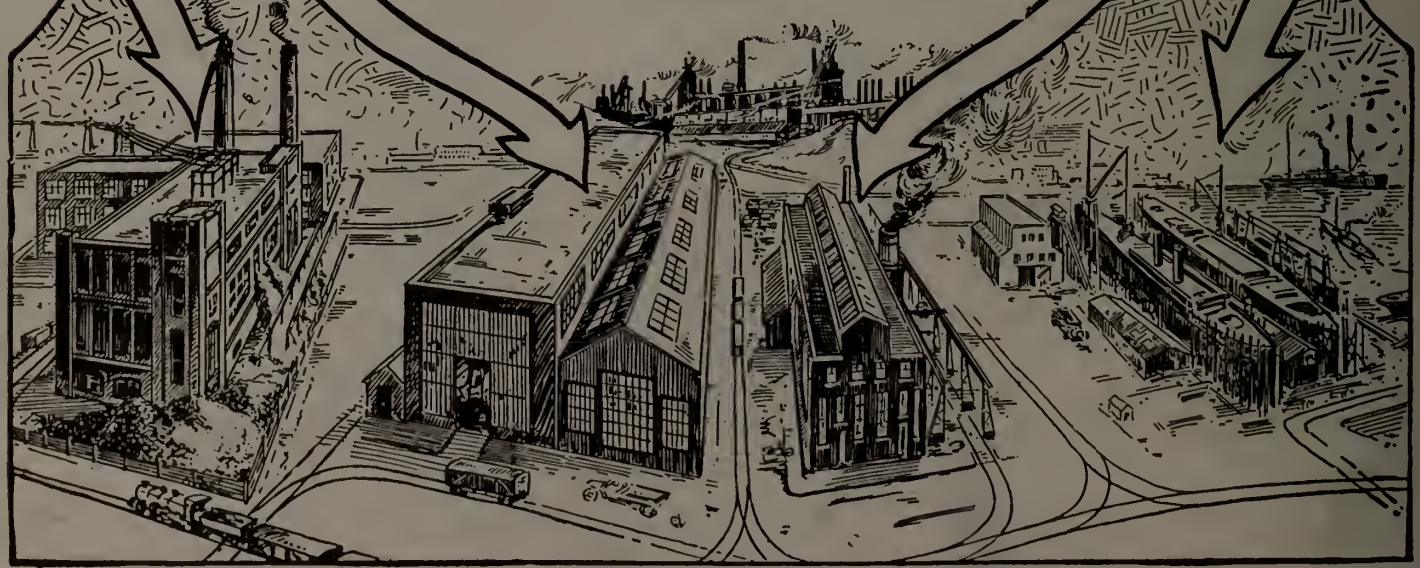
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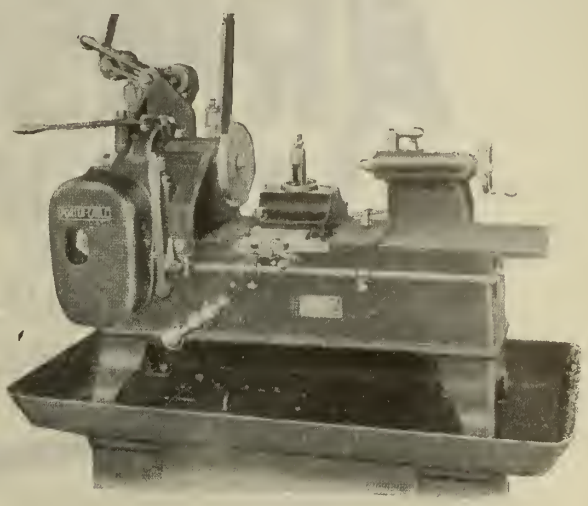
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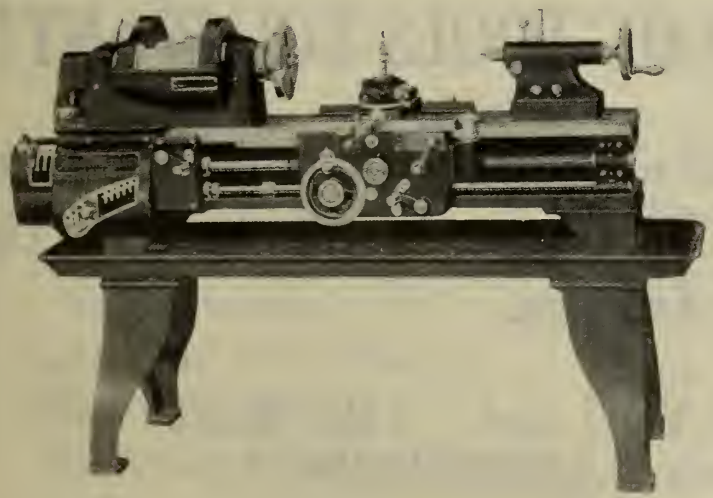
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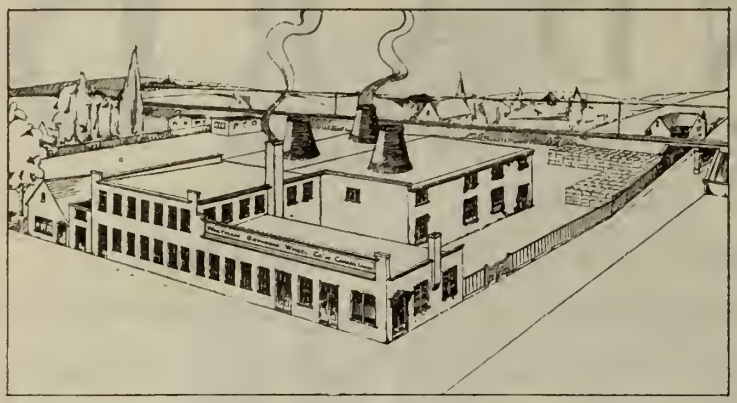
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We specialize in equipping plants fully; we also provide needed supplies. Customers say that our service is extraordinarily good. We'll do our best to please you.

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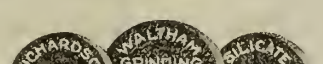
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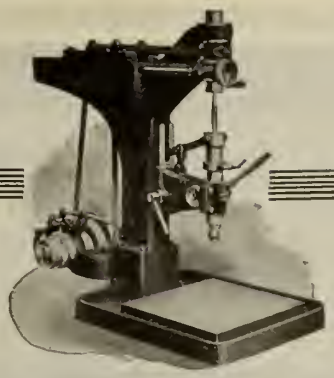
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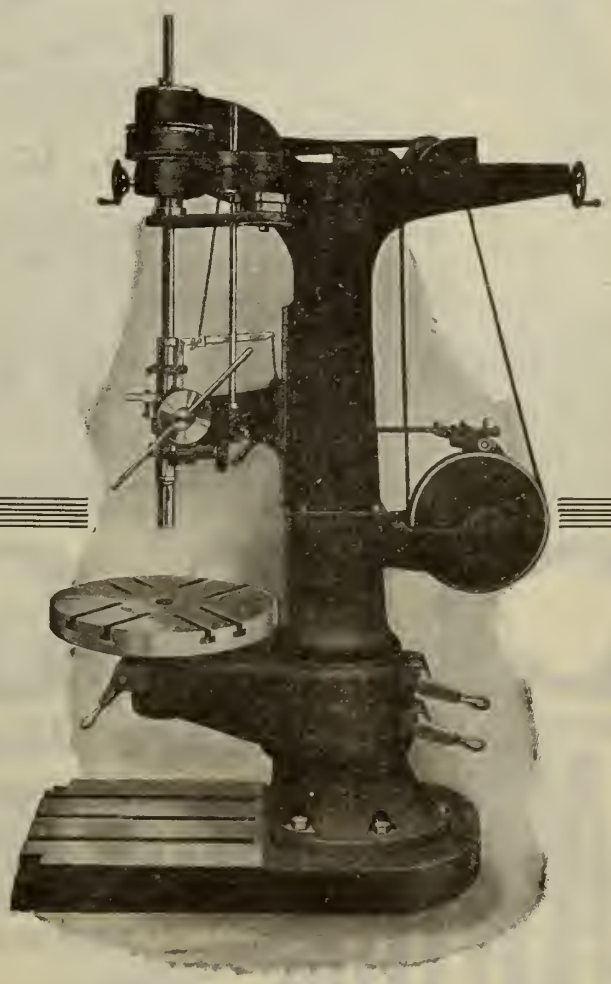
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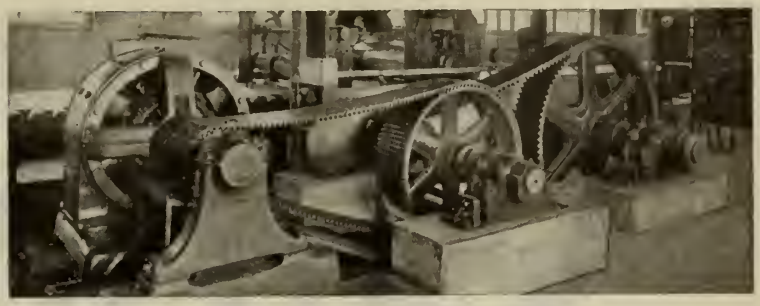
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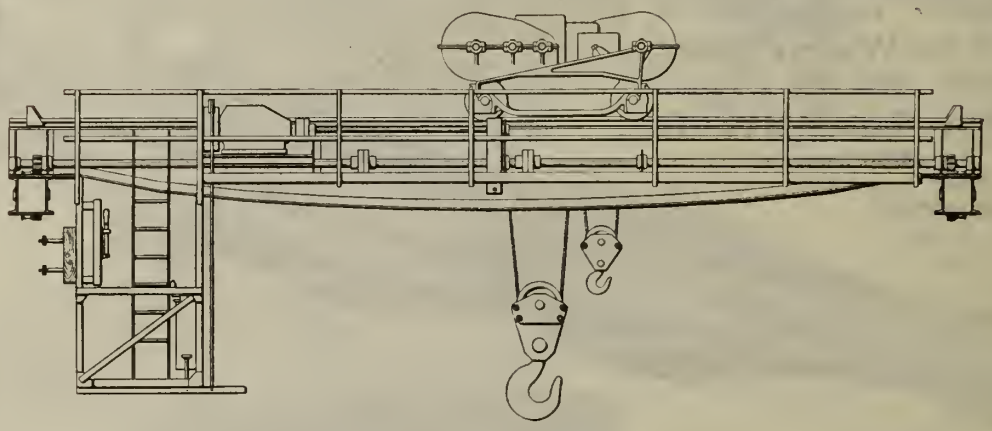
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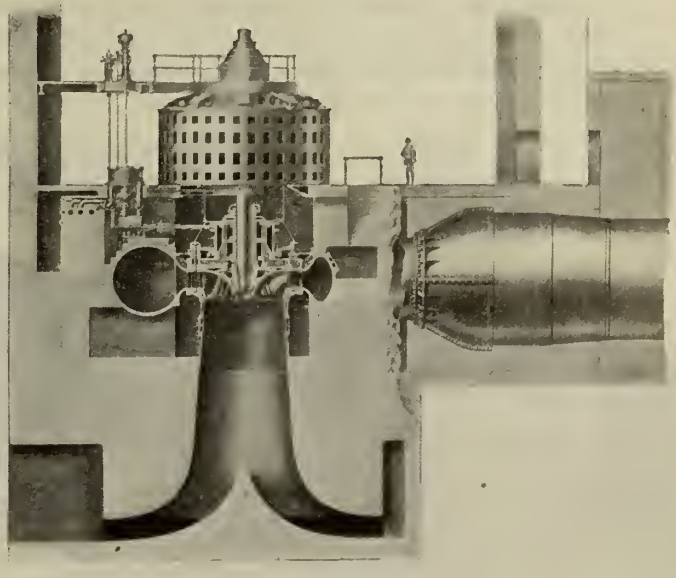
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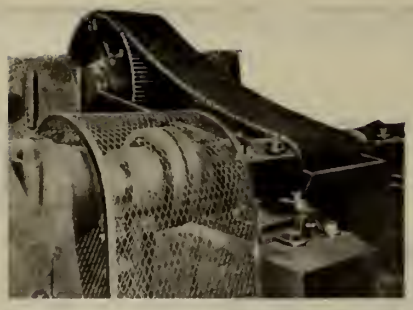
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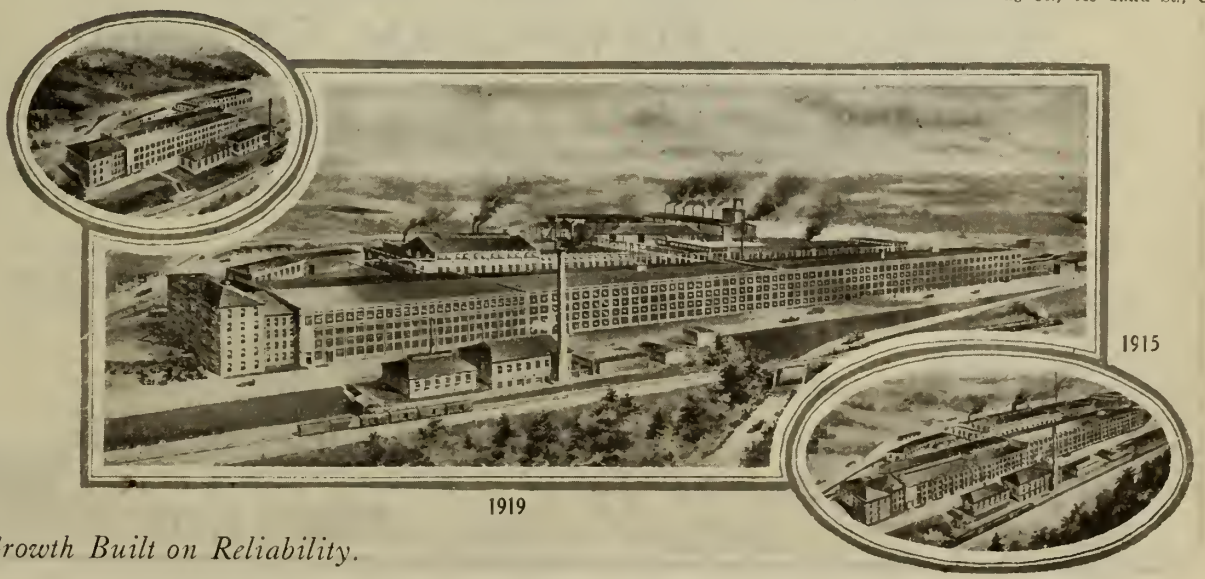
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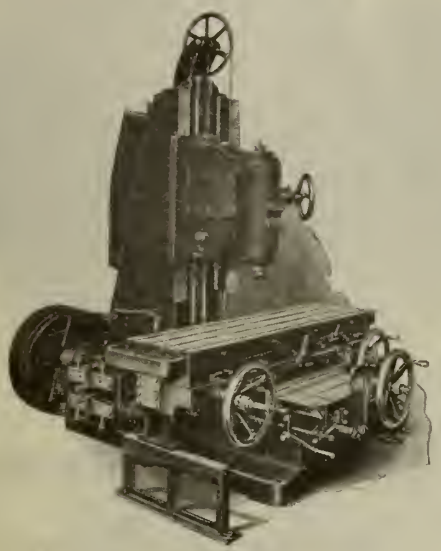
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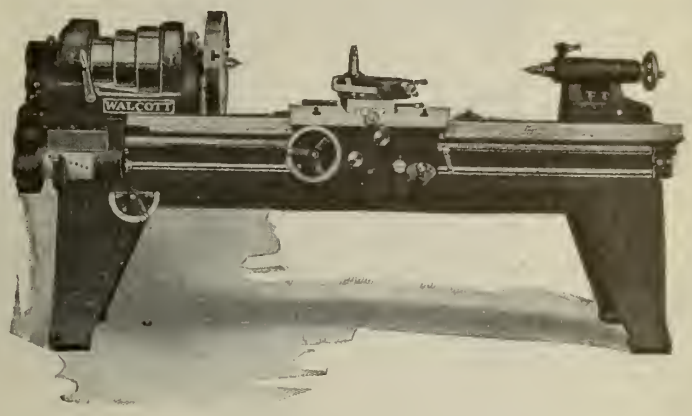
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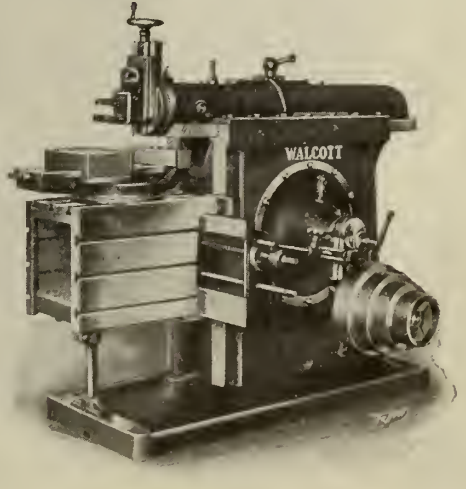


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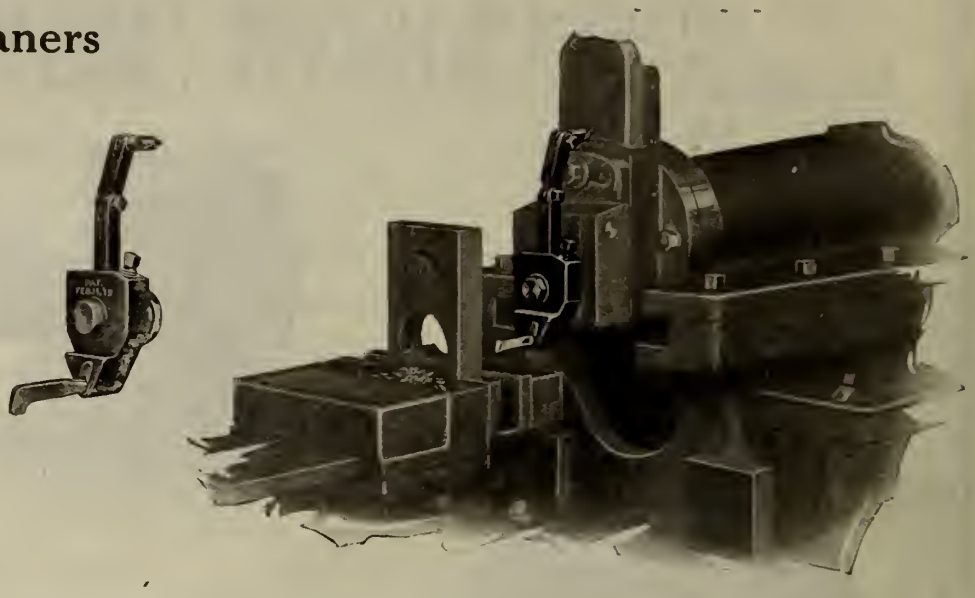
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Equips Your Shaper to do the Work of a $1,000 Slotter



Used extensively in large plants on production as well as in small shops, tool rooms, etc., making possible intricate shaping on jigs, gauges, dies, key ways, slotting, etc.

It is bolted to the clapper in place of the tool post and can be applied as easily and as quickly as changing a tool.

Each attachment is equipped with two round shank cutting tools which may be turned to cut from any angle. Square shank cutting tools may be used if desired.

Specify size desired.

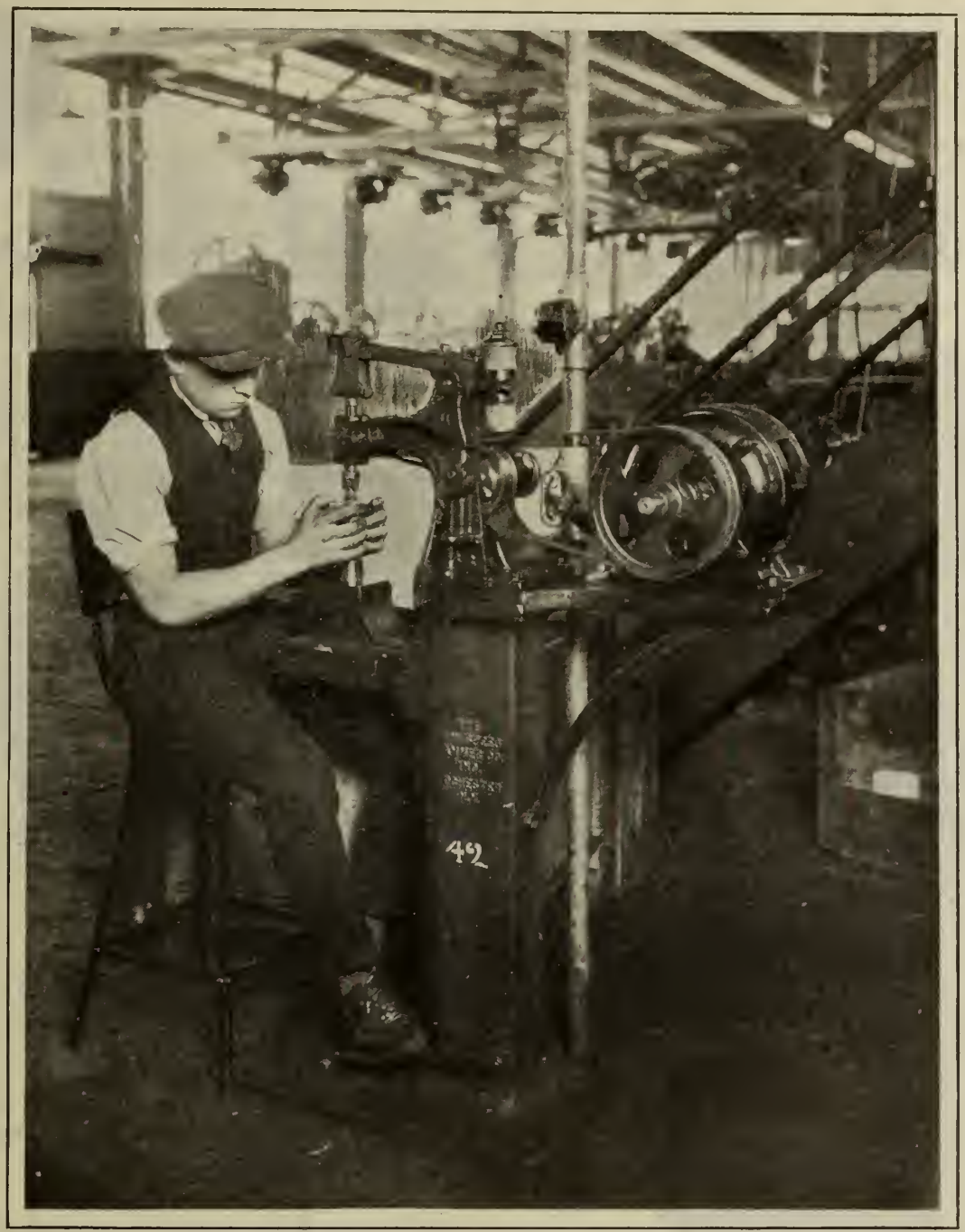
Sizes

No. 0 takes 3/8" to 1/2" round shank
No. 1 takes 1/2" to 5/8" round shank
No. 2 takes 5/8" to 3/4" round shank

H. A. MOORE COMPANY

ROCHESTER, N.Y., U.S.A.

If interested tear out this page and place with letters to beisers listed under proper heading.



Speeding Up Production with a

HIGH SPEED RIVETING HAMMER

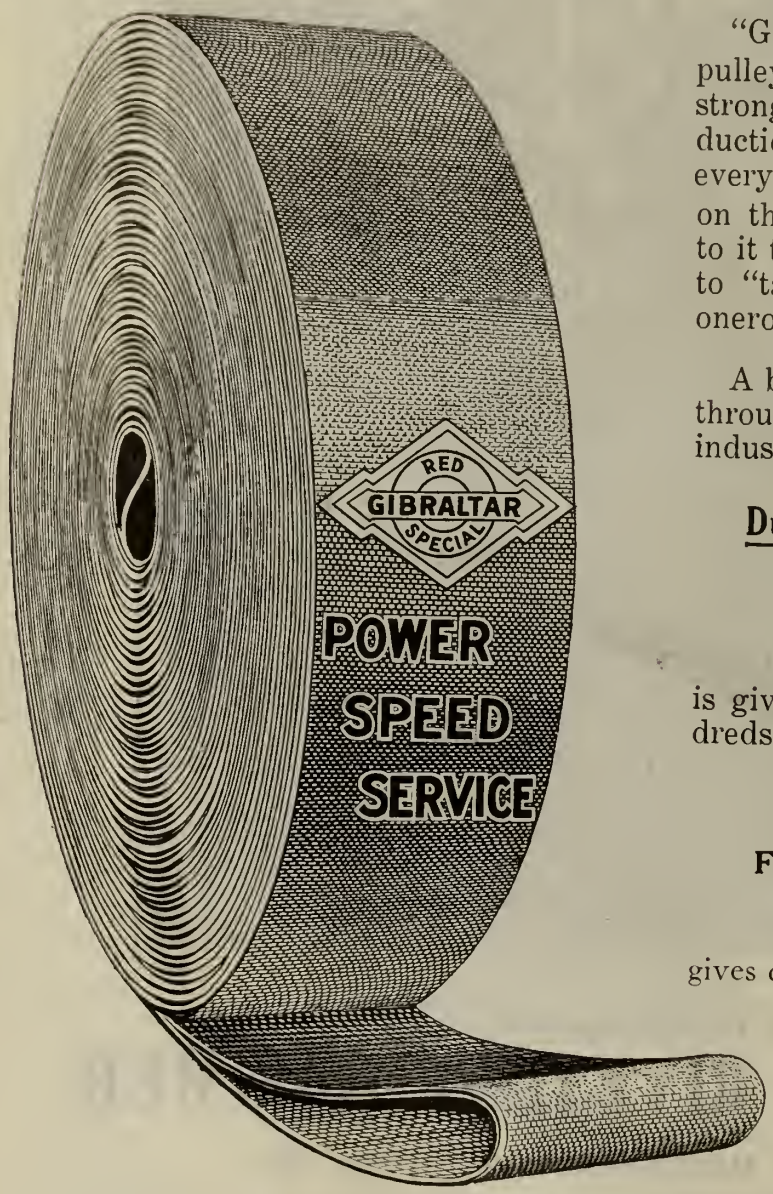
"PATENTED"

AT THE ROBBINS & MYERS PLANT, BRANTFORD, ONT.

This Canadian plant is a branch of the famous Robbins & Myers Company of Springfield, Ohio, one of the largest manufacturers of motors in America. The Canadian plant is finely equipped to take care of domestic and export trade, and efficient and economical production is carried to a fine point. Only the best of machine tools are used. Included among these tools is the High Speed Riveting Hammer.

HIGH SPEED HAMMER COMPANY, Inc.

ROCHESTER, N.Y., U.S.A.



"Gibraltar RedSpecial" Belting
--Cuts Down Producing Costs--

"Gibraltar RedSpecial" Belting is pulley-gripping, non-slipping, pliable, strong. It cuts down the cost of production by faithfully transmitting every vestige of power and keeping on the job. There is so little stretch to it that users tell us they haven't had to "take it up" in several years of onerous service.

A big percentage of the orders going through the factory are repeats from industries which have tried its worth.

Dunlop "Gibraltar RedSpecial"

Water Hose
Air Drill Hose
Steam Hose

is giving highest satisfaction in hundreds of plants the country over.

Dunlop Packing

For All Purposes and Every Condition of Service

gives dependable service just the same as Dunlop Belting and Hose.

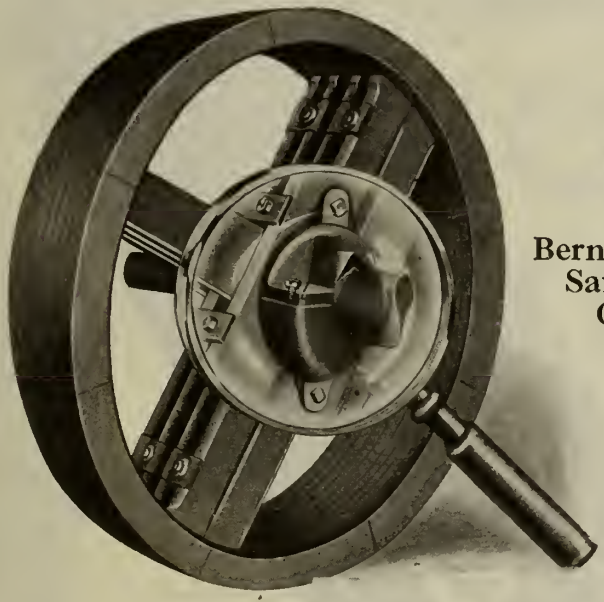
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Head Office and Factories: TORONTO
Branches in the Leading Cities

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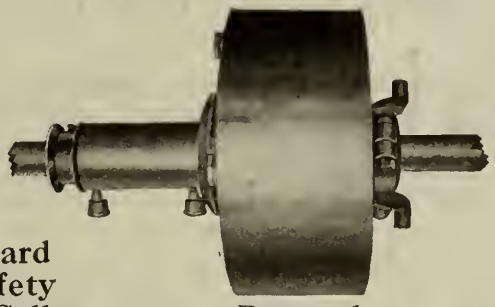
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BERNARD

Transmission Appliances



Bernard Safety Collar



Bernard Friction Clutch

You should adopt the Bernard Friction Clutch—built on the most advanced principles, safe, simple, reliable and inexpensive.

Bernard Wood Split Pulleys

Bernard Pulleys are economical Pulleys. Their durability enables them to stand up under the most severe working tests.

They have demonstrated their superiority in hundreds of Canadian plants. They are lighter than solid, split iron or steel pulleys, and thus permit the use of less expensive shafting and hangers. They put less weight on bearings, reduce friction, and save power. For economy and efficiency in the transmission of power, use Bernard Wood Split Pulleys.



The A. Bernard Industrial Co.

Manufacturers of High-Grade Power Transmission Appliances

Offices and Works: FORTIERVILLE, Que.

Safety

Satisfaction

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STELLITE

Not Steel—but its Master

STELLITE Tools are a permanent guarantee of longer service, quicker work and better work. Stellite tools can be worked faster than high-speed tools, and can take heavier cuts. Stellite tools last longer between grinding.

The manufacturer who seeks higher shop efficiency sees and appreciates Stellite Superiority—a metal harder than steel, of high tensile strength, capable of doing more work than high-speed steel, and doing it more quickly and economically — not steel, but the master of steel.



STELLITE is a cutting metal that cannot be annealed, tempered or heat-treated. It resists oxidation. At red heat, when high-speed steel tools break down, Stellite tools cut at their best. The hotter they get up to 1800 F. the tougher they get, and the longer they last. If you would have your shop produce its maximum, at a minimum of expense, use Stellite tools.

Deloro Smelting & Refining Co., Limited

Head Office and Works:
DELORO CANADA

Branch Warehouses:
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26 Abermarle Street, London, Eng.

THE MASTER METAL



Schieren's "DUXBAK" BELTING

Wherever the wheels of the world's varied industries hum you'll find SCHIEREN'S DUXBAK BELTINGS transmitting the power efficiently and faithfully year in and year out.

When it comes to selecting belting that is capable of resisting the effects of water, machinery oils, and acid fumes, you want DUXBAK WATERPROOF—the most widely used belting in the world.

In mills, shops, factories and other places where the belting must transmit the load continuously, and "stand-up" with minimum expense —use ROYAL EXTRA.

For belting that is extremely pliable, impervious to steam and water, and particularly adaptable for use on small pulleys running at high speed—DUXBAK NUTAN is unequalled.

In fact, there's a grade of SCHIEREN DUXBAK BELTING to meet every belting need.

The Schieren Trade Mark and the Chas. A. Schieren Company signature appears on every ten feet of DUXBAK BELTING—your guarantee of genuineness and service. A service it will pay you to investigate.

For Sale
Eastern Canada
FOSS MACHINERY & SUPPLY CO.
MONTREAL, P.Q.

DUXBAK BELTING TRADE MARK

Chas. A. Schieren Company
ESTABLISHED 1848

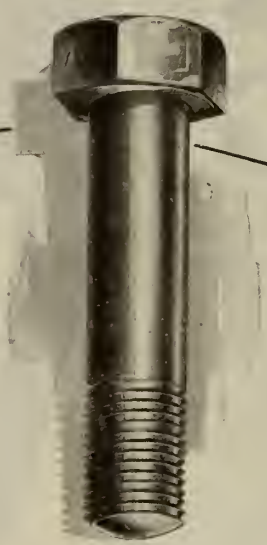
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GALT SCREWS







TRY a dozen or more Galt Screws of any size with a micrometer gauge. You will be struck with their precise uniformity of size. What does this accuracy in Galt Screws mean to their users? It means that they can always be depended upon to fit! Screws that always fit save a lot of time, trouble and money.

It is the dependable accuracy in Galt Screws that has brought them into wide demand for the building of machine tools throughout Canada.

TO THE MANUFACTURER:

We furnish accurate and therefore interchangeable parts, whether it be Cap and Set Screws, U.S.S. or Plain and Castellated S.A.E. Nuts, Taper Pins, or the more difficult automatic parts for engines, transmission and axles. Our facilities for doing secondary operations, such as drilling, milling, grinding, case-hardening and heat-treating are up-to-the-minute.

Submit Us Your Blueprints for Estimates

THE GALT MACHINE SCREW COMPANY, LIMITED

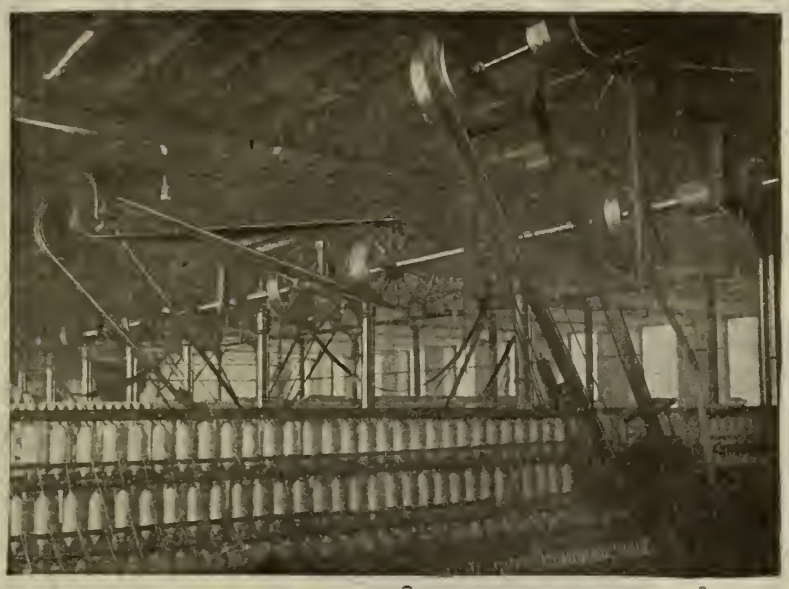
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Eastern Representatives : **F. Bacon & Co., 131 St. Paul St., Montreal, Quebec**



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Solid Woven Belting



"Twintex" driving Mules in Cotton Mill

Cotton **Twintex** **Hair**

No plies to open up

Non-slip driving surface

Anti-friction edge

Maximum flexibility

Unequalled for strength and service

WHY NOT WRITE US? WE CAN HELP YOU

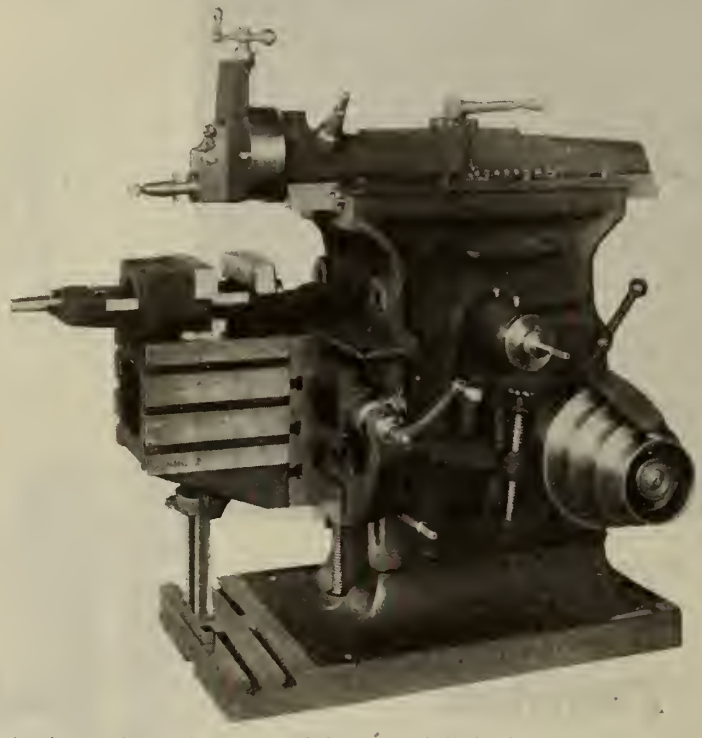
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McKENZIE Improved

15" Back Geared Crank Shaper



"This new 15-inch Shaper recently placed upon the market by the D. McKenzie Machinery Company, Guelph, has several new features and improvements over the machine built in the past.

The New Extension base affords a much larger foundation for the machine, which is provided with a supporting leg always directly under the weight of the table so that the weight is evenly divided at all times. The Box Table can be removed and the work bolted to the saddle. The Screw for raising the cross-rail is fitted with ball bearings. The Vise Jaws have steel faces with circular graduated base and is arranged so that it will swivel and hold firmly at any angle. The Cone Pulley runs on a sleeve-journal bearing. The Ram has square slides and is provided with felt wipers. The extreme length of stroke is 17" and is adjusted from the operating side of the machine. The Tool Head is fitted with a tapered gib and can be tilted to any degree. All Feeds have graduated collars.

The D. McKenzie Machinery Co.

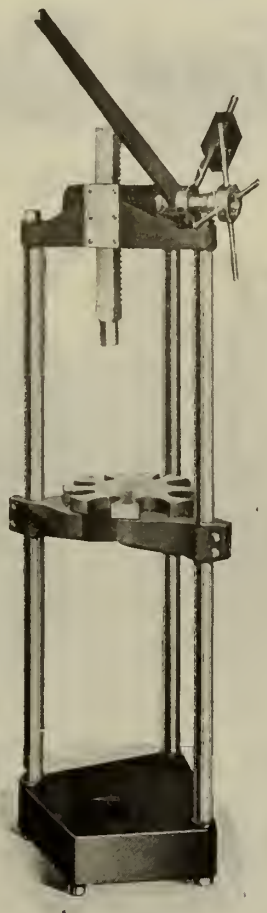
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The NECO ARBOR PRESS

The Powerful "three point" construction permits the maximum of strain with perfect alignment.

The Ratchet Feed with the long leverage giving unexcelled power, together with the automatic release, obtains easy and efficient operation.

Capacity, 3 tons
Clearance, 16 inches
Floor space, 20 inches.



Patents Pending

The Adjustable Table and 36-inch range give it an unusual capacity for service.

Its design and construction are up to the standards and advancement of all "NECO" production where Merit and Service are paramount.

Openings in dial for nine sizes of arbors up to 3½ inches.

We do not put all the strain on one tooth of the ratchet—We put the strain on all the teeth all the time.

THE "NECO" ARBOR PRESS

meets the requirements of the most exacting shop practice where efficiency and production count. Its sturdy, rigid construction and wide range of productive capacity are appreciated by users who know and want practical appliances. It is one of the most useful units of modern shop equipment. Just the thing for the Auto Repair Shop. Price $125.00.

Manufactured by

The National Engineering Company, Limited, Sarnia, Canada

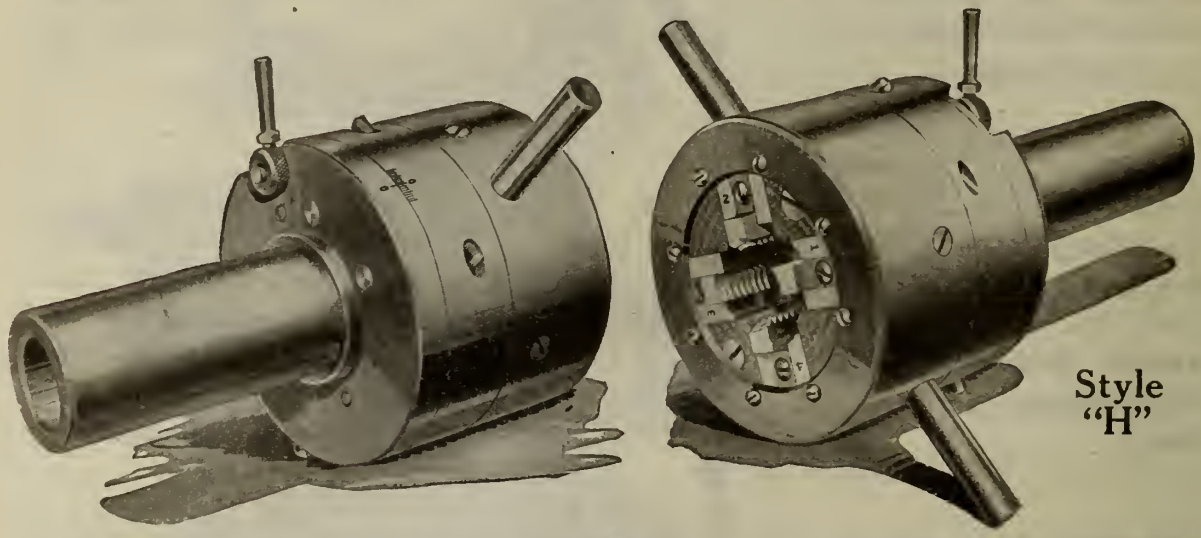
Selling Agents:

The A. R. WILLIAMS MACHINERY CO., Toronto, Halifax, St. John, Montreal, Winnipeg, Vancouver.
Standard Foundry & Supply Co., Walkerville, Ont. Peninsula Equipment Co., 50½ King St. E., Hamilton
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MODERN
Self-Opening Die Heads

(One Type - Two Styles - 17 Sizes)



Style "H"

THEY HANDLE JOBS OTHERS CAN'T

Everywhere you find Moderns on difficult jobs. "Moderns" are almost daily supplanting other types because of efficiency on hard to handle work.

WHAT'S THE SECRET?

The ability of Modern Self-Opening Die Heads to do work not possible for others is largely due to "Modern" distinctive design, although superfine workmanship is entitled to some of the credit.

Chasers in Modern Self-Opening Die Heads have ample and mechanically correct support. Users are not subjected to the annoyances of chasers shifting position during work. They will not "rock," "cock," or "bell at the mouth."

Based on record of accomplishment we've no hesitancy in claiming that Modern Self-Opening Die Heads will produce accurate, uniform threads the longest time without repairs.

Moderns have numerous mechanical advantages.

Send for complete technical bulletin, and study the reasons why Modern is preferred in the most exacting plants.

MODERN TOOL CO. - ERIE, PA.

Main Office and Works: State and Peach Streets

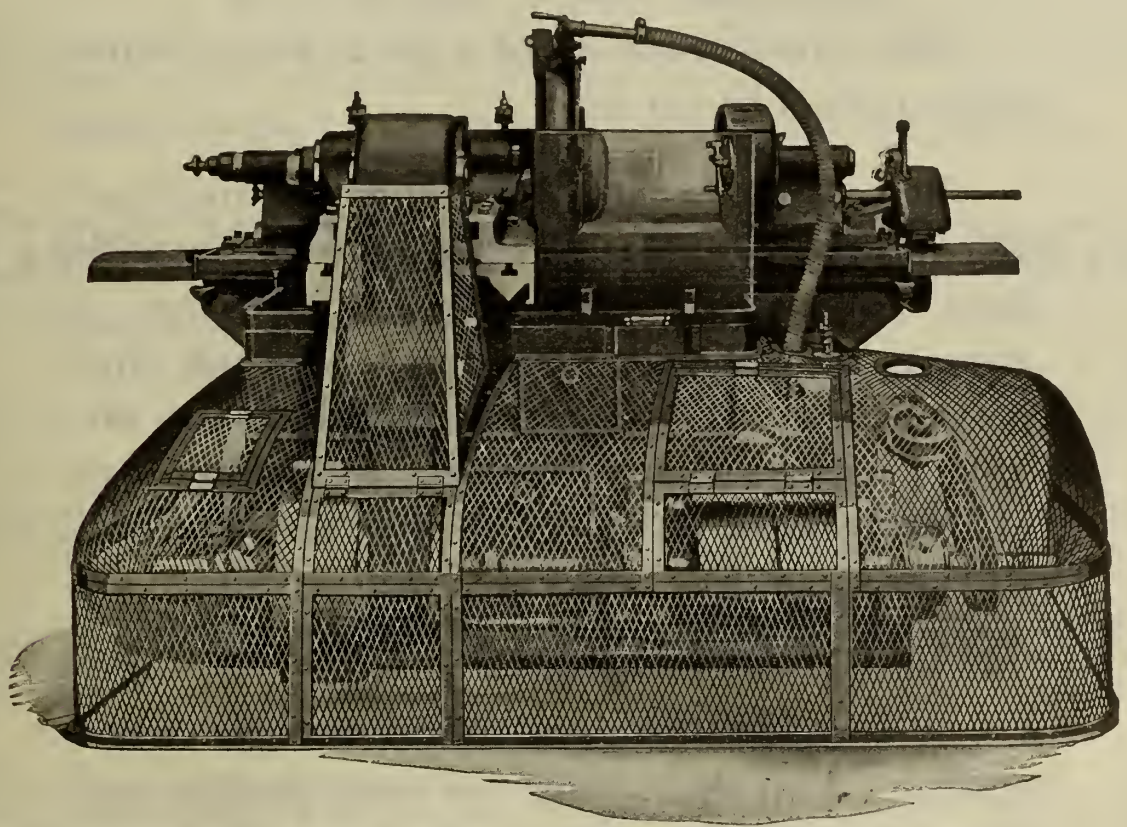
Branch Offices:

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MODERN
Plain Grinding Machines

(8 Sizes -- 8" x 18" to 16" x 60")



ANOTHER SUPERIORITY FOR "MODERN"

Now Fitted With Perfected, Open Vision Guard

The new guards which are now fitted to all Modern Plain Grinding Machines are a great improvement over the heavy, cumbersome, cast iron guards in general use. They are light, strong, safe, and efficient. They are in meshlike construction of expanded, or perforated metal which affords an almost unobstructed view of all moving parts. Meets the most rigid requirements of all safety laws. Our technical bulletin will explain fully how one of our eight sizes may be adapted to your use.

MODERN TOOL CO. - ERIE, PA.

Main Office and Works: State and Peach Streets

Canadian Agents:
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If It's for the Shop or Factory

STRELINGER'S

Have It

Our stock consists of a great many items and covers a broad field.

No matter whether you have a machine shop, a factory, a mill, a warehouse, a tinsmith shop, a plumbers' and steamfitters' shop, a garage, a woodworking shop, a welding and cutting shop, or you are a contractor or engineer, or are in any one of many other lines of business, we have equipment that you use, and you owe it to yourself to let us figure on your requirements.

We are here to serve you to the best of our ability. You can count on *good quality*, *low prices*, and *fair treatment*, when you deal with us.

We earnestly solicit your inquiries.

THE CHAS. A. STRELINGER CO.
OF CANADA, LIMITED

Machinery - Tools - Shop Supplies

126 FERRY STREET - WINDSOR, ONTARIO

From a Needle to an Anchor

or

From an Ounce to Ten Tons

is indeed a wide statement and an achievement we would be proud to proclaim if it were a fact. But we have only been in the business fourteen years and any reasoning person does not need to be told that it would require the effort of several lifetimes to build an organization capable of substantiating such a claim.

We Want Your Business

which demands that we have your confidence. So we will only say that we are prepared to give you a service (Quality, Delivery and Price) on your

REPETITION, LIGHT TO MEDIUM WEIGHT, BENCH AND FLOOR

GREY IRON CASTINGS

that will place you permanently among our supporters and friends.

A TRIAL ORDER is Our Only ARGUMENT

Send us your patterns and specifications and be convinced to your continued profit.

Do Your Castings Cost Too Much?

A rearrangement of your patterns might cut their cost 25%; a different method of molding them might double your production at no increase in molding cost.

Do You Intend to Build Some Machine

or produce some article which will require a large number of each separate casting? A proper arrangement of your pattern—with the correct method of molding it—is the first step toward bed-rock cost production.

Do You Need Some New Patterns?

Send us a sample, blueprint or sketch for advice. It won't cost you anything. If our advice commends itself to you, it is only fair to assume that our work will be equally satisfactory.

We do pattern work, as an aid to making castings, and it is not to our advantage to advise a hundred-dollar pattern where a cheaper one will deliver the same casting results. Neither would we be a party to your having an expensive plate made with two pieces on it, where you could get six at no greater molding expense—which we have seen done. But we will tell you EXACTLY how to arrange your pattern to get the lowest casting cost with the minimum expense for pattern equipment.

WE SPECIALIZE ON REPETITION CASTINGS

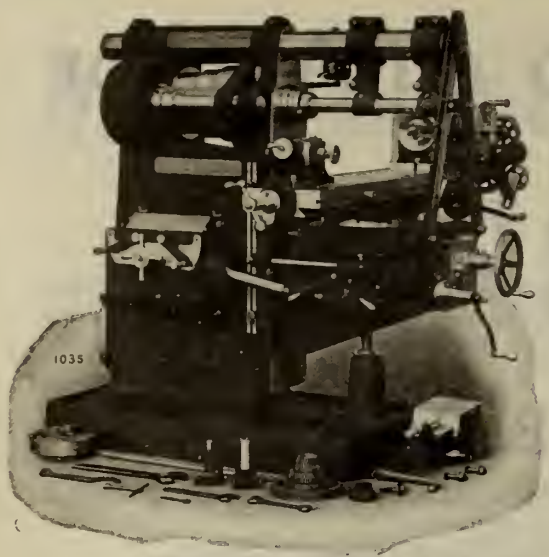
The knowledge gained in twenty years of practical experience on these problems, and our entire equipment is at your service in the effort to obtain BETTER CASTINGS, CHEAPER.

THE TRADE K-A-T MARK FDY. The Katie Foundry
Galt, Ont.

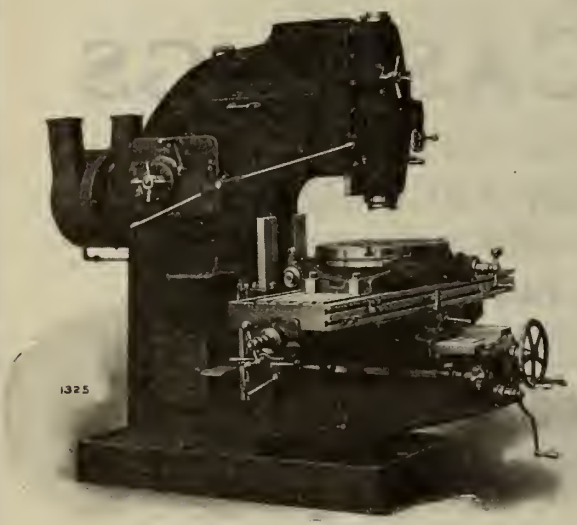
We are in a position to do turning, boring, drilling or other semi-finishing operations on castings supplied by us.

We have for our and your requirements, a large stock of assorted White Iron Stars, suitable for light agricultural to medium weight machinery castings, while they last, at 8 cents per lb. F.O.B. Galt.

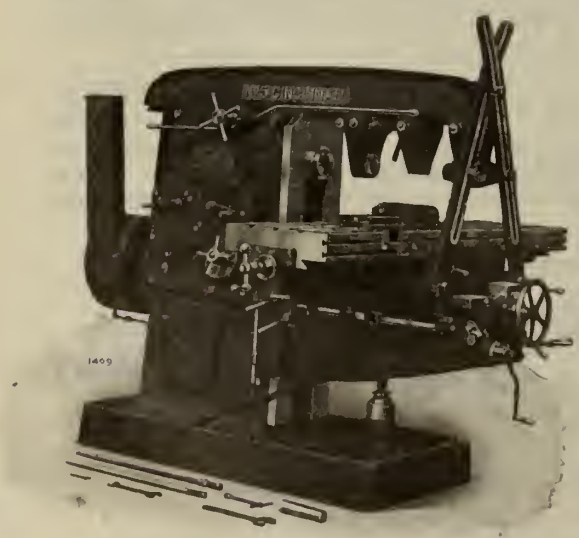
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One of our cone-driven Universal Millers. We make 8 correspondin; single pulley type machines.



One of our five sizes of single pulley type, vertical Millers.



One of our 8 high power single pulley plain Millers. We also make 4 cone driven plain machines.

THE Manufacturer who is looking for any one specific size and type of Milling Machine, can exactly satisfy his need from the line of Cincinnati Milling Machines. Included is every commercial size—from 18 in. table travel to 50 in. table travel—from 1 h.p. normal capacity to 20 h.p.—from 1,450 lbs. net weight to 11,000 lbs.—and between these two extremes, 27 sizes and styles of Horizontal Millers. In addition to that a full line of Vertical Millers and Automatic Manufacturing Millers.

You will grant that from such a complete line, you can fill your shop's needs in Millers as perfectly as a plug gauge fits its corresponding ring. A few of them are shown on this page. All of them have won the highest reputation everywhere. Complete details are given in our literature, which will be sent to anyone who is interested.

The Cincinnati Milling Machine Company

CINCINNATI, OHIO, U.S.A.

H. W. PETRIE, LTD.
Toronto

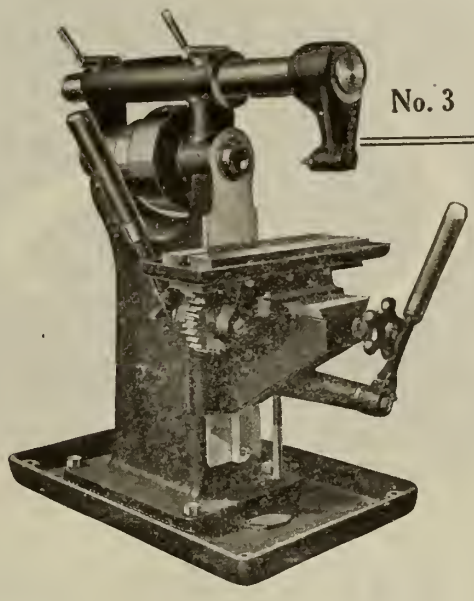
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H. W. PETRIE OF MONTREAL, LTD
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Burke

Bench Milling Machines



No. 3

Accurate, Convenient and Economical!

THESE handy, compact little machines will handle much of the work usually done on the large millers. Their strong construction and lack of all unnecessary parts make them extremely popular. They work accurately every day in the year and their high efficiency is maintained throughout a longer period than that of the average mlling machine. From the standpoint of economy it will be much to your advantage to investigate these Burke Bench Millers.



No.4

Burke Bench Miller No. 3

This accurate little machine will soon pay for itself in the variety of jobs it will handle. Will take care of much of the work usually done on the large machines. Fitted with slotting attachment, vertical milling attachment, index centres—either stationary or tilting heads, etc.

Burke Bench Miller No. 4

Another efficient, compact machine that should be in every workshop. Longitudinal table feed 8". Traverse feed 3". Maximum distance between center of spindle and table 8". Attachments same as furnished with No. 3 machine.

Let us explain further the possibilities of a Burke in your plant. Catalogue of Milling Machines, Drill Presses, Tapping Machines, etc., on request.

BURKE MACHINE TOOL CO.

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For sale by: H. W. Petrie, Ltd.; National Machinery & Supply Co.; A. R. Williams Machinery & Supply; Canadian Fairbanks-Morse Co.; Williams & Wilson; Garlock-Walker Machinery Co.; Yeates Machinery Co.; Cope & Son, and Geo. F. Foss Machinery & Supply Co.

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Steel Chrome Manganese Nickel

CASTINGS

Annealed and unannealed

DEPENDABLE Steel Castings for Cement Mills and Mining Machinery, Stamp Mills, Crushing Plants, Excavating Outfits, Steel Car Wheels, Locomotive Driving Wheels and Frames, etc.

MACHINE-MOLDED GEARS

There's no pattern expense when you use "HISCO" Machine - Molded Gears. Made up to 18 feet in diameter.

They are right in quality, accurate, and low in price.

Write us for Estimates

HULL IRON & STEEL FOUNDRIES, LTD.

HULL, CANADA

1921

"RedCut Superior"

NATIONALLY KNOWN FIRST QUALITY

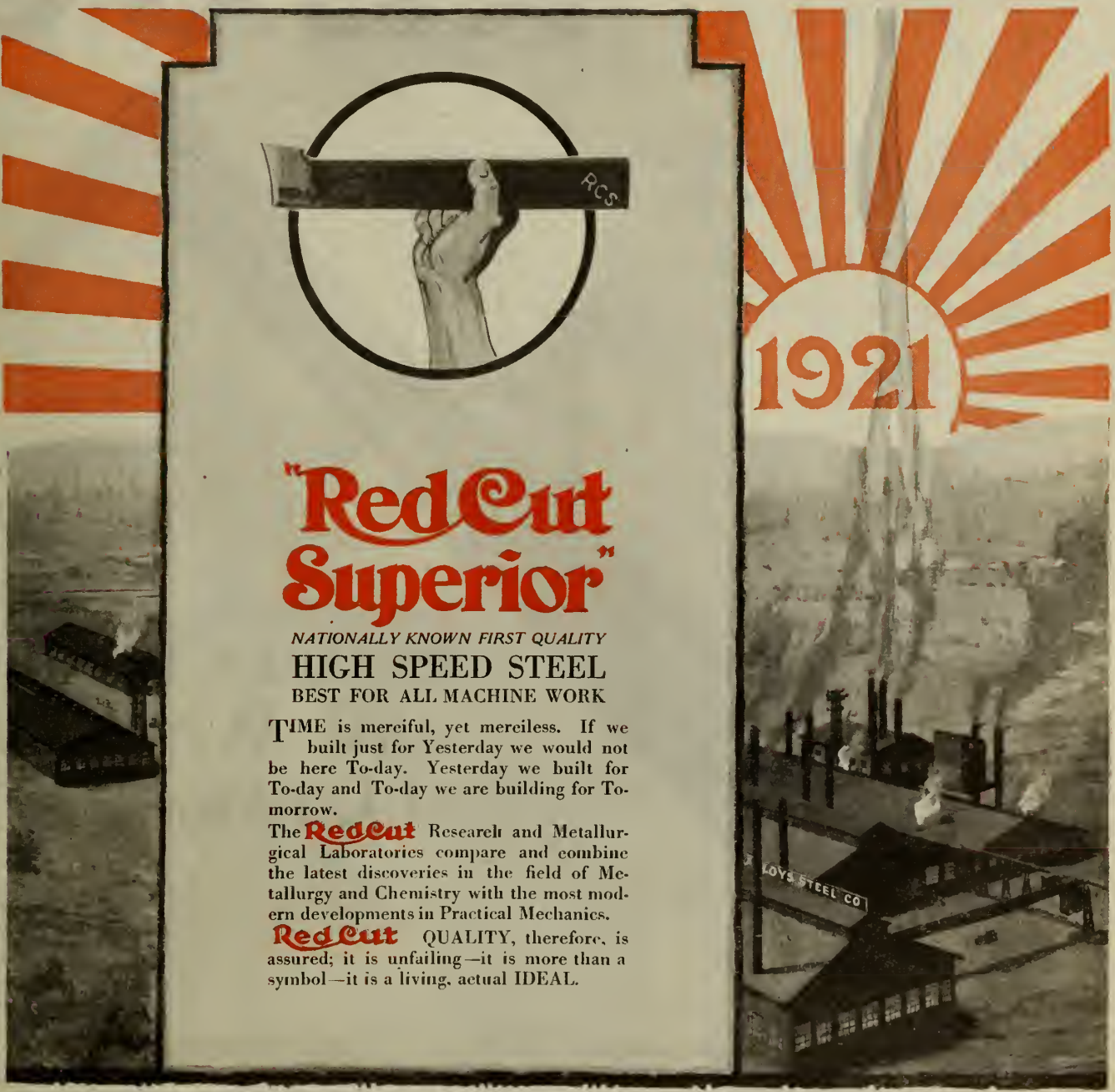
HIGH SPEED STEEL

BEST FOR ALL MACHINE WORK

TIME is merciful, yet merciless. If we built just for Yesterday we would not be here To-day. Yesterday we built for To-day and To-day we are building for To-morrow.

The **RedCut** Research and Metallurgical Laboratories compare and combine the latest discoveries in the field of Metallurgy and Chemistry with the most modern developments in Practical Mechanics.

RedCut QUALITY, therefore, is assured; it is unfailing—it is more than a symbol—it is a living, actual IDEAL.



VANADIUM-ALLOYS STEEL COMPANY

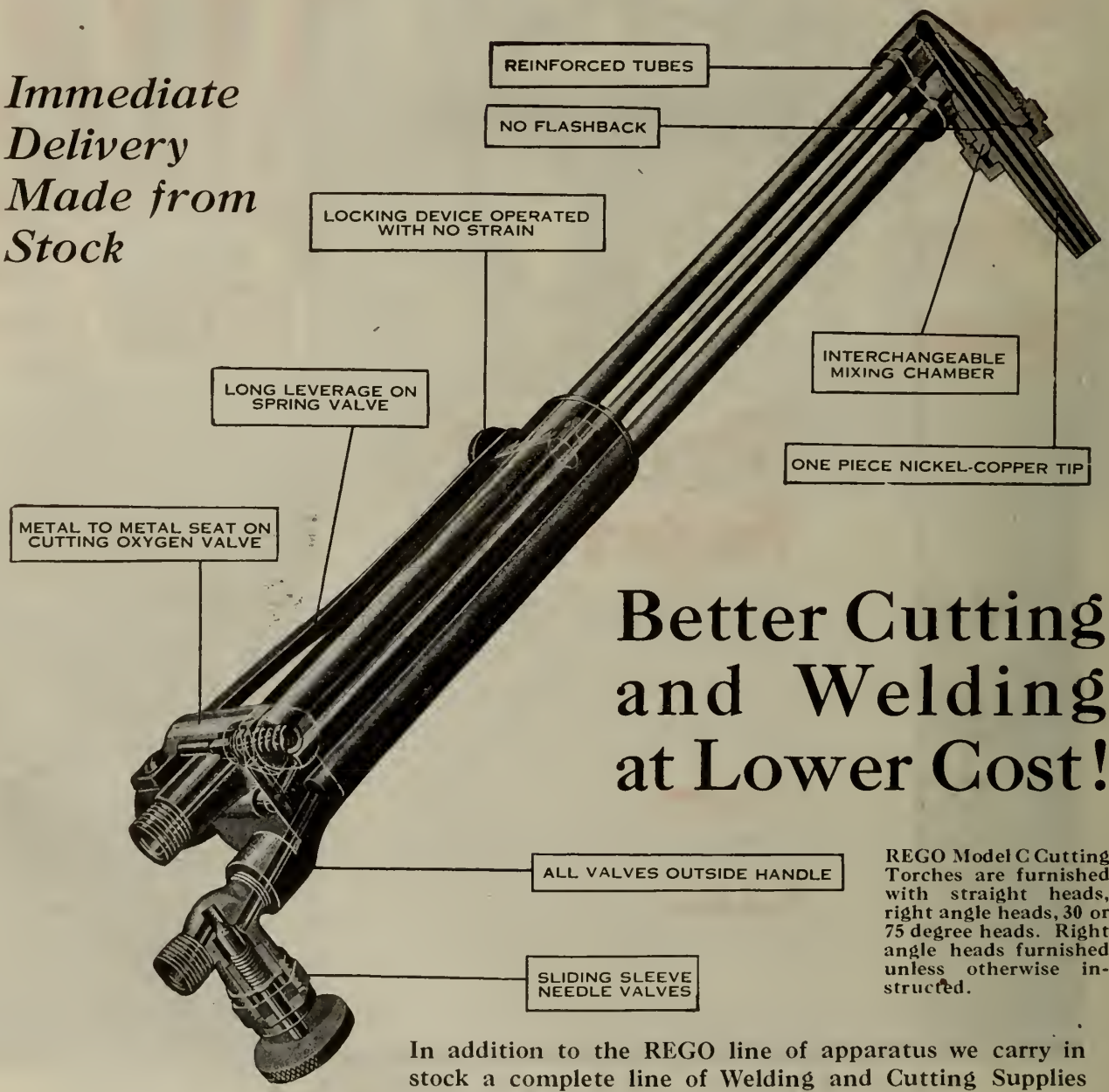
MAIN OFFICE AND WORKS: LATROBE, PA.

BRANCHES:

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REGO

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Better Cutting and Welding at Lower Cost!

REGO Model C Cutting Torches are furnished with straight heads, right angle heads, 30 or 75 degree heads. Right angle heads furnished unless otherwise instructed.

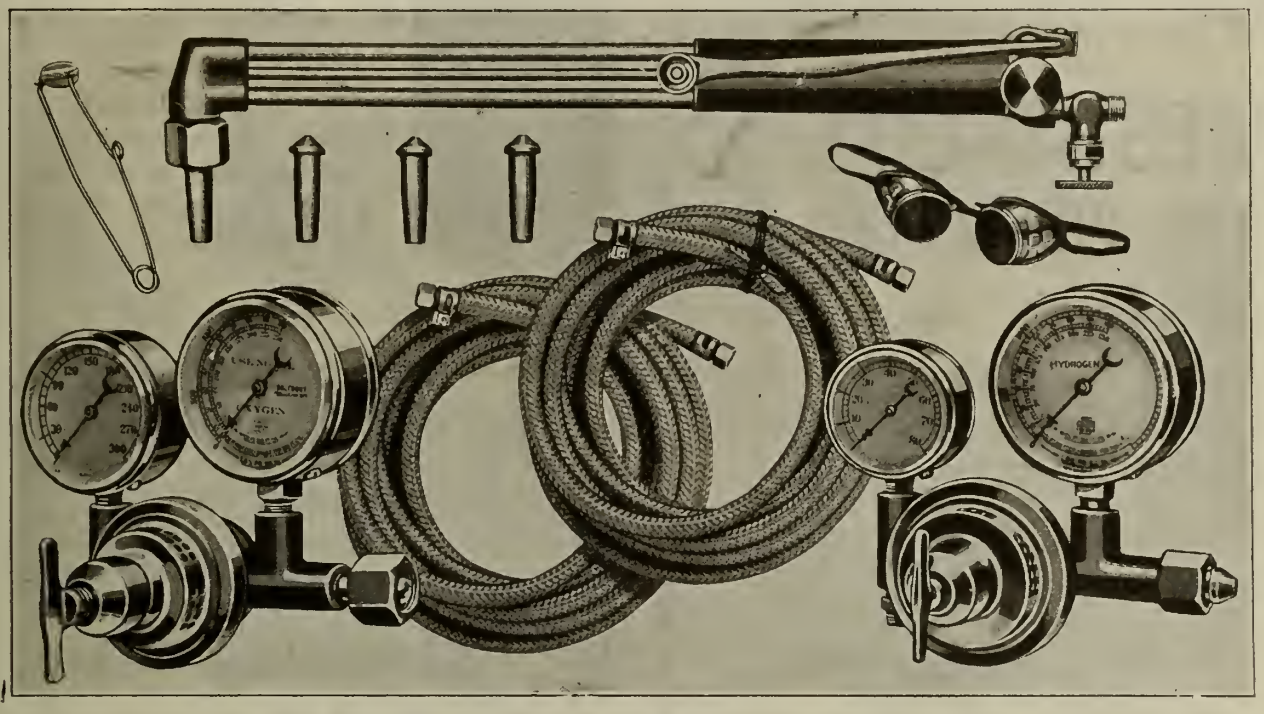
In addition to the REGO line of apparatus we carry in stock a complete line of Welding and Cutting Supplies and Accessories. Also Oxygen and Acetylene Gases.

Sole Distributors

THE CARTER WELDING

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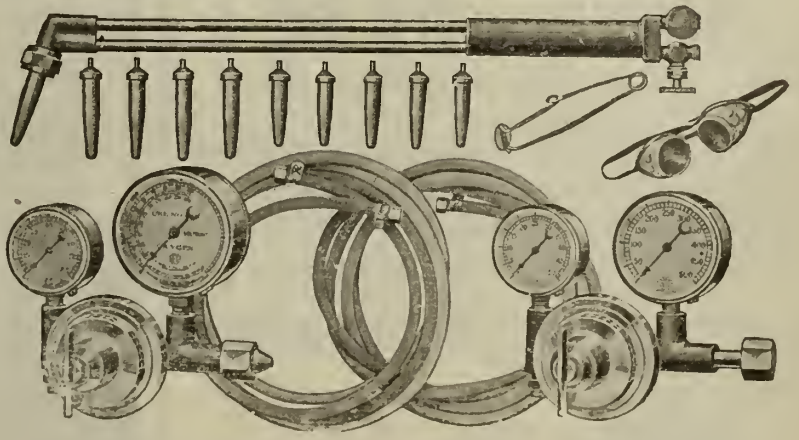
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THE PORTABLE

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Welding & Cutting

Oxy-Acetylene Apparatus

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It provides many exclusive developments for mechanical welding and cutting.

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You will want to know all about it—what it will accomplish, and what it will save. You will want a Lincoln engineer to conduct an investigation in your establishment. You will permit him to make experimental welds.

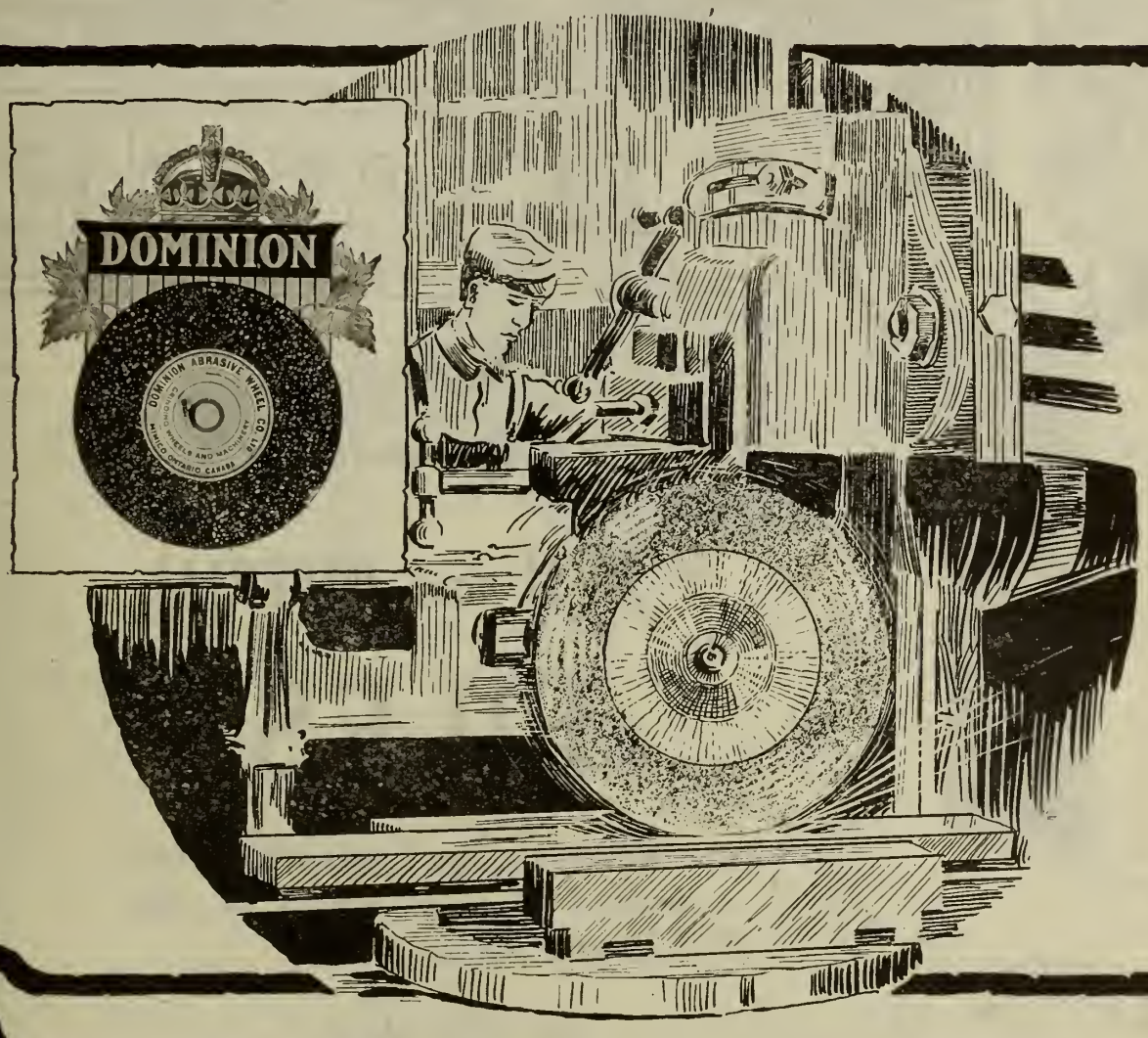
As we have said, you will eventually decide that a Lincoln Electric Welder in your shop would, without a doubt, save time and money.

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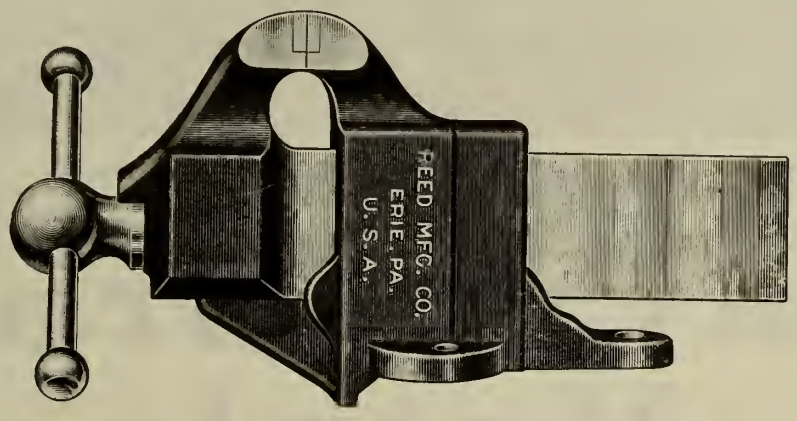
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Special Screw Machine Product up to 4" diam

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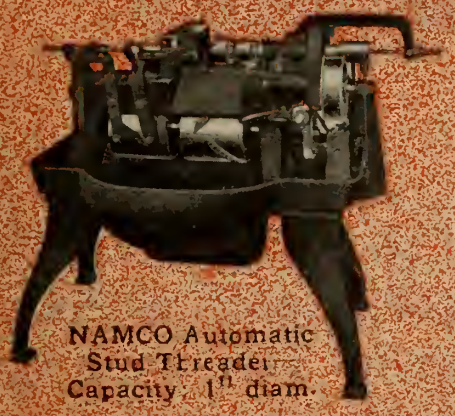
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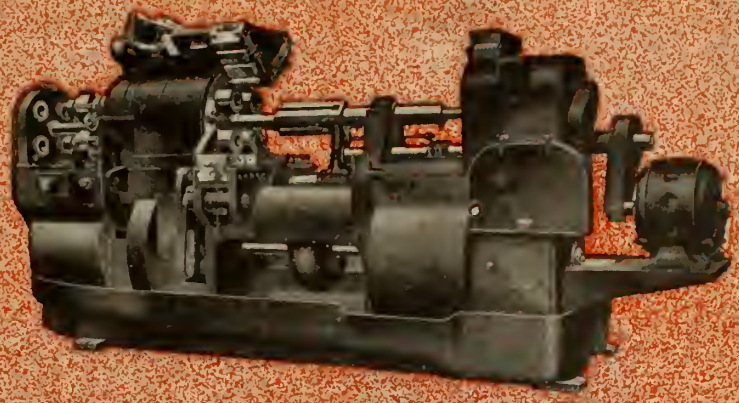
NAMCO Automatic Stud Threader Capacity 1" diam.



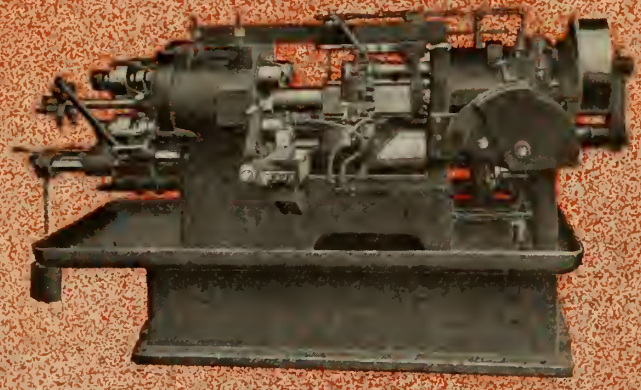
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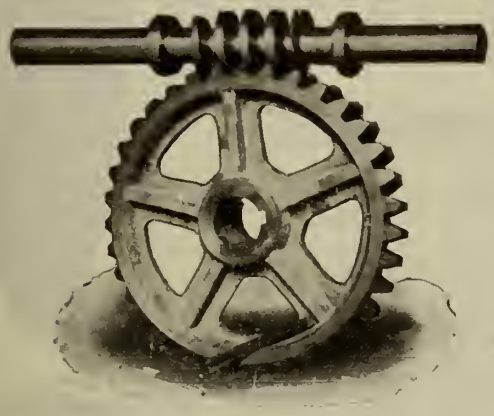
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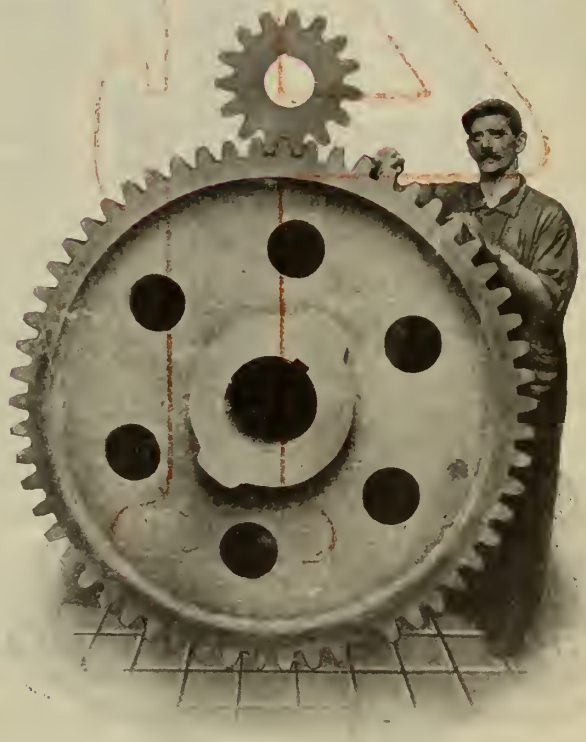
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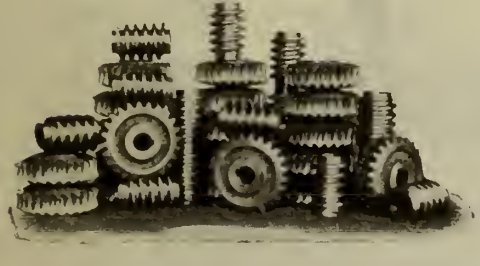


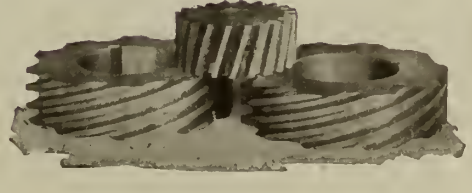


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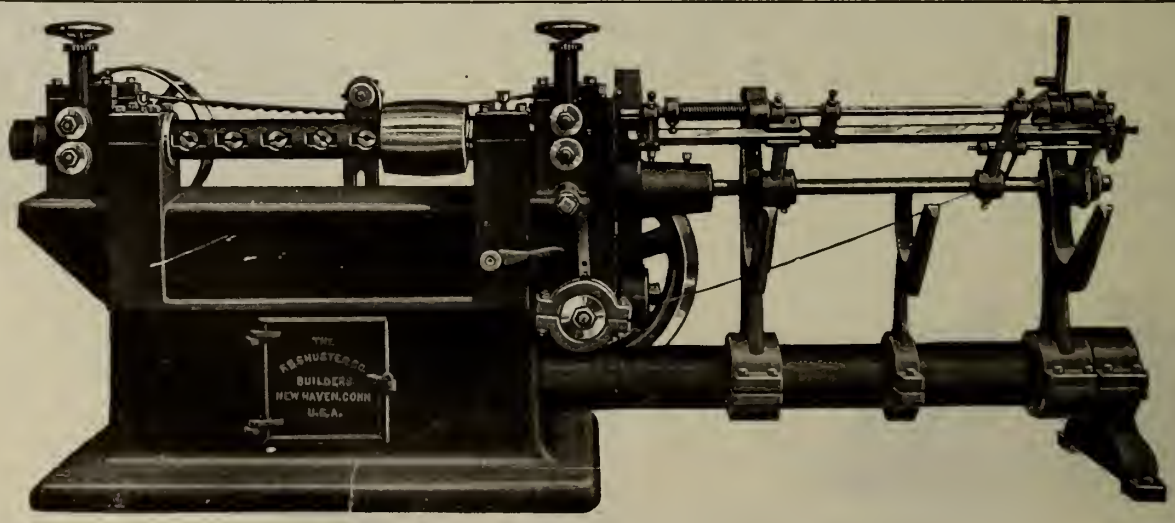
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ALSO MAKERS OF STRAIGHTENERS FOR SQUARES, HEXAGONS, FLATS, ETC.

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For Heavy Duty

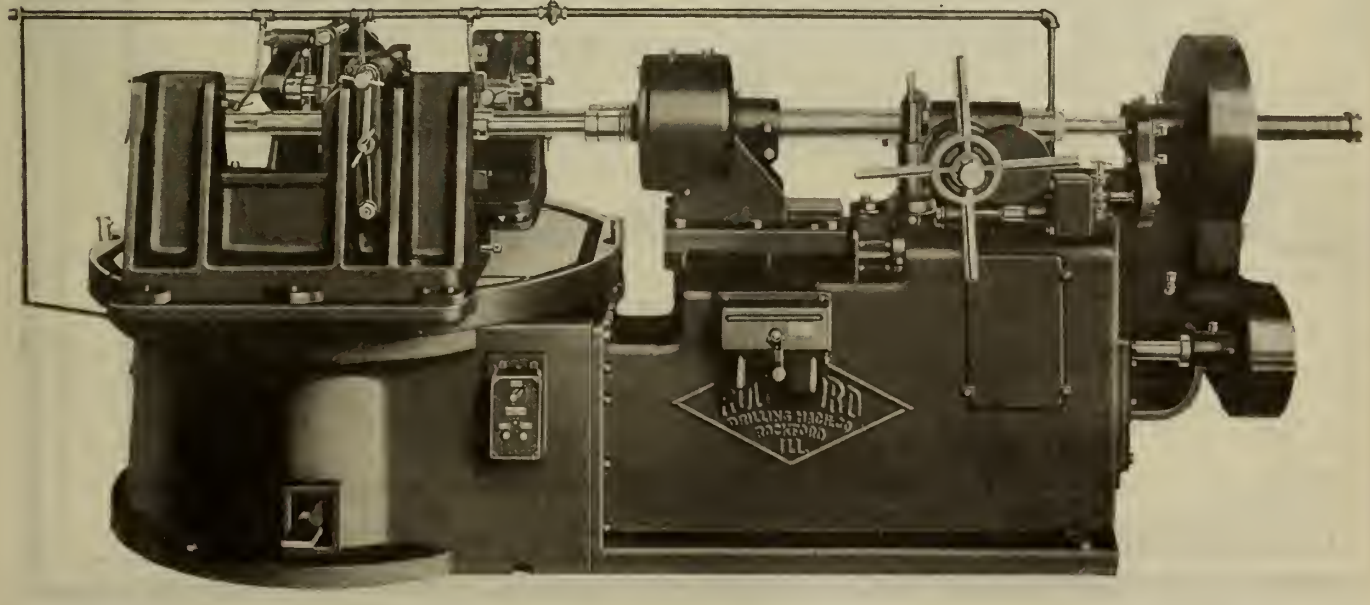
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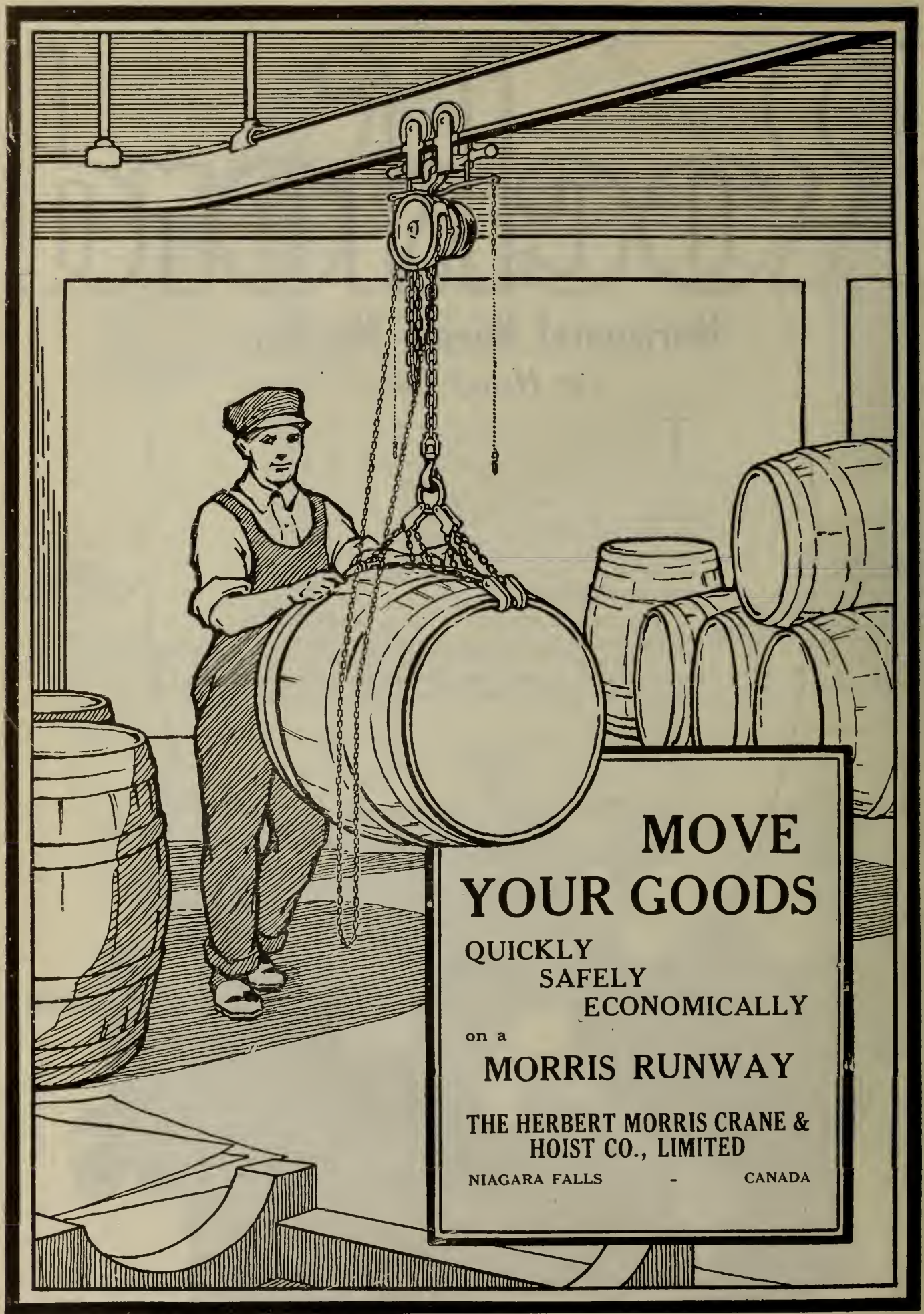
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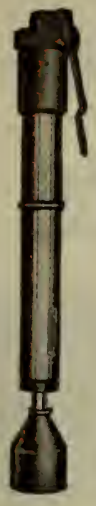
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A catalog and bulletins describing the many money-saving Thor Tools is yours upon request. Write to-day.

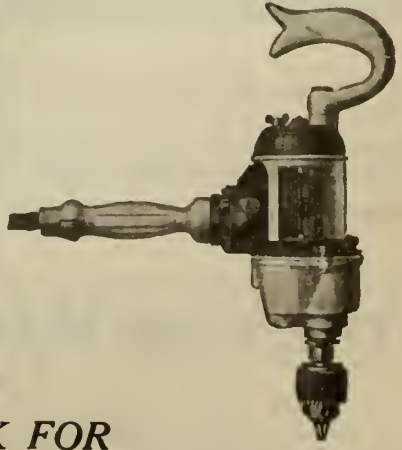
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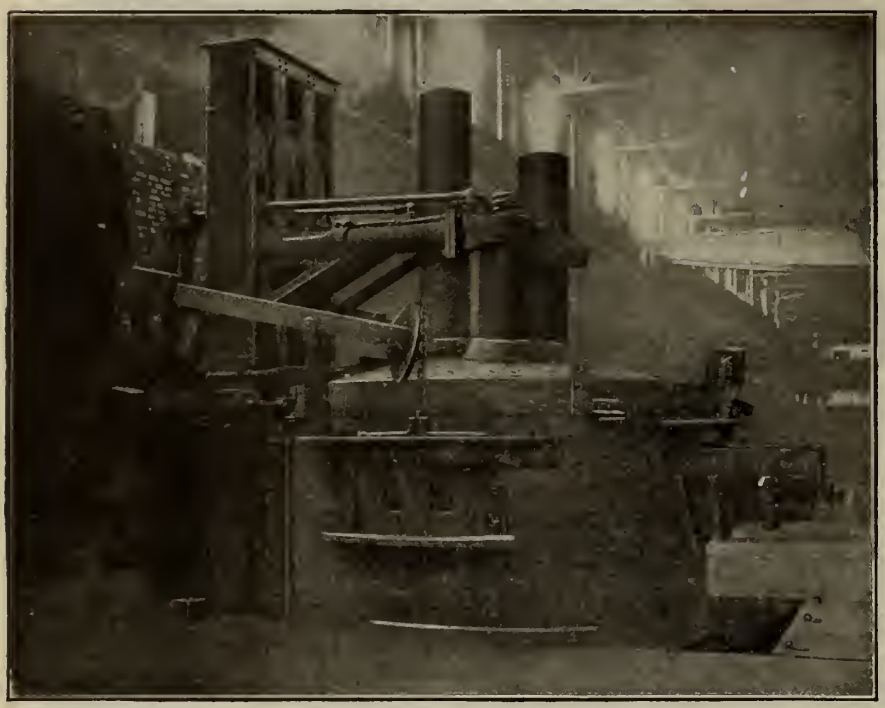






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ANACONDA BELT

Driving the Agitator in a Dissolving Tank



THE belt in the picture is driving the agitator in a dissolving tank in the recovery room of a kraft mill.

The belt is subject to extreme heat; the only thing protecting it from the direct flame is a thin sheet of steel.

OTHER belts previously used on this machine only gave 50 per cent. of the service given by our ANACONDA, which is a heat, acid, and waterproof belt, and will withstand just such atmospheric conditions.

MAIN BELTING COMPANY OF CANADA LIMITED

MONTREAL: 10 St. Peter St. **TORONTO: 32 Front St. W.**

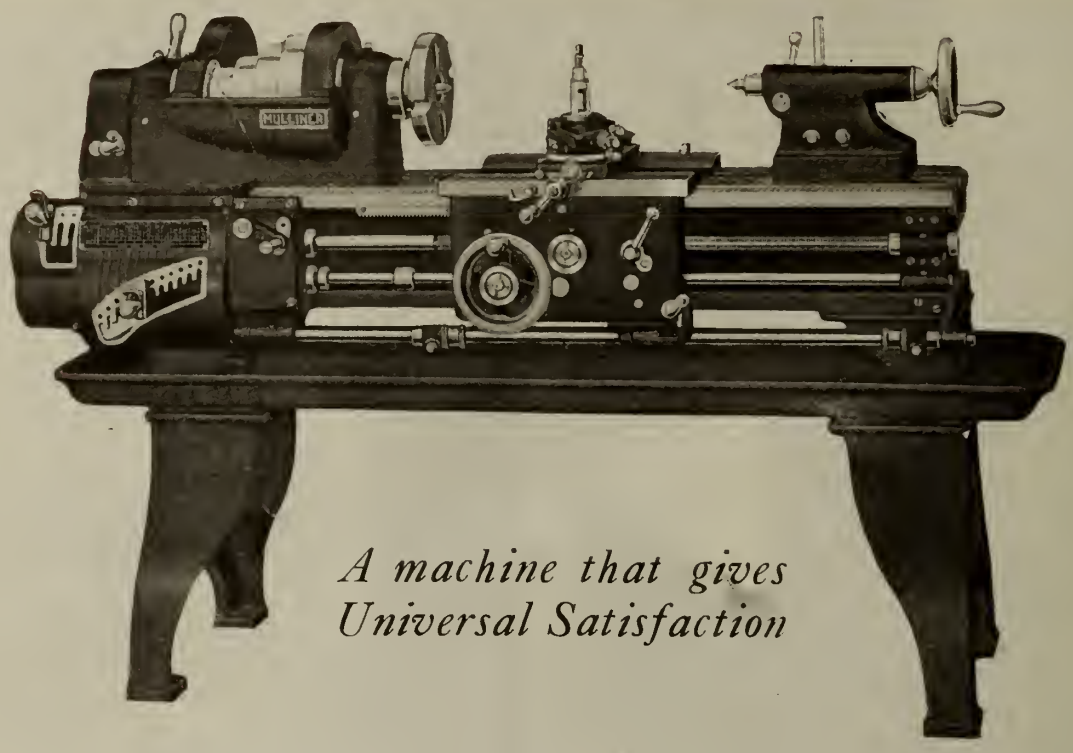
WINNIPEG: W. W. Hicks, 567 Banning St.

CALGARY and EDMONTON: Gorman, Clancey & Grindley, Edmonton

If interested tear out this page and place with letters to be answered.

MUELLER

Heavy Duty Engine Lathe



A machine that gives
Universal Satisfaction

Give It Your Attention Before Purchasing Another Lathe

ALL we have to say about the Heavy Duty MUELLER Engine Lathe is this: If you need an 18-in. Engine Lathe and fail to get a proposal on the MUELLER, you have missed an opportunity of a lifetime.

The next move is yours.

MUELLER Radial Drills and Lathes
Sold in Canada Exclusively by

FOR SALE IN CANADA BY

The GEO. F. FOSS MACHINERY & SUPPLY COMPANY LIMITED

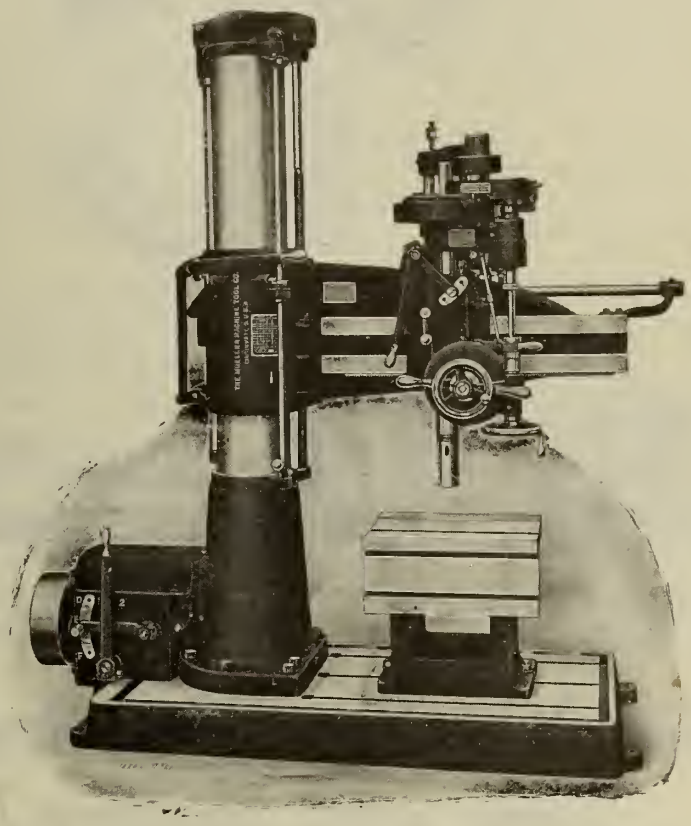
305 St. James Street, Montreal, Quebec

MUELLER

Heavy Duty Radial Drill

Rigid, Powerful, Accurately-Adjusted Milling Machine

It's a Leader



THE Heavy Duty MUELLER Radial Drill is a distinctive outfit. It is different in many ways from the average radial drill, and in consequence the results obtained with our machines are out of the ordinary. For rigidity it has no equal. It has no limit when it comes to pulling capacity, and years of service will not impair its wonderful alignment and durability.

Here is the point: We have just made what may sound to you like a rather strong statement, but, we will stick to it and are ready to prove it to anyone thinking of installing a radial drill. Is that you, Mr. Reader?

MUELLER Radial Drills have been Manufactured in Cincinnati, Ohio, Since 1902 by THE MUELLER MACHINE TOOL COMPANY

FOR SALE IN CANADA BY

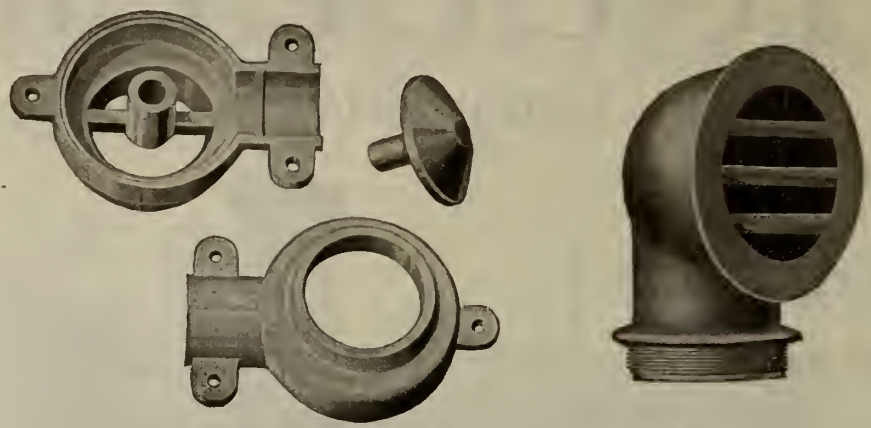
The GEO. F. FOSS MACHINERY & SUPPLY COMPANY LIMITED

305 St. James Street, Montreal, Quebec

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DIE-CASTINGS

DOEHLER PROCESS



Note the smooth appearance of the Die-Castings in the illustration. No burrs—no rough spots. Cored holes are perfectly round and centred. Require practically no machining

SEND BLUE PRINTS TO US FOR ESTIMATES

Manufactured by



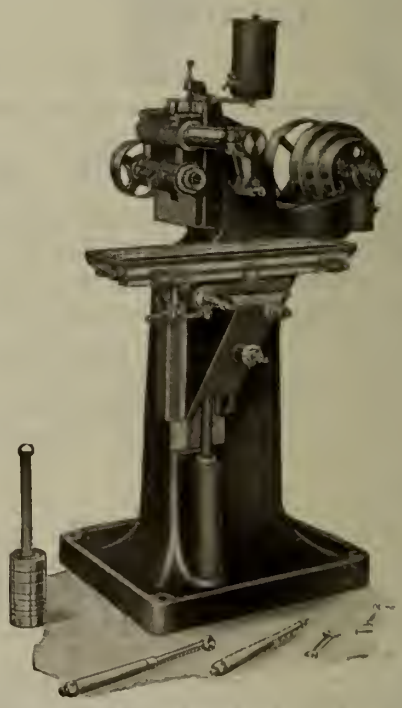
Tallman Brass & Metal Limited

HAMILTON, ONT.



Are You Throwing Away Time and Money?

This is practically what you are doing if you are in the habit of putting small milling jobs on your big millers when you can do the work **much quicker** and **more efficiently** on



The U.S. MILLER

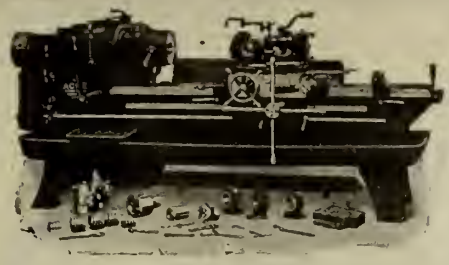
THE MILLER FOR SMALL WORK

A small, sturdy, perfectly designed machine that takes up little floor space—the paramount miller of its size.

Let us have a word from you relative to your line of milling work. We will reply with a plain and candid statement as to the possibilities of the U.S. Miller in your shop; many concerns have done this and we have demonstrated conclusively that the U.S. Miller would cut milling costs from one-third to one-half; to-day these concerns are glad they took the trouble to write. **You decide to write now.**

UNITED STATES MACHINE TOOL COMPANY

Cincinnati, Ohio, U.S.A.



Cincinnati Acme

The Cincinnati Acme Line

The Cincinnati Acme line of machine tools include Flat Turret Lathes, Screw Machines, Turret Lathes, Brass Working Machines, Universal Turret Lathes and all accessories. Every Cincinnati Acme Tool is designed on the most modern principles.

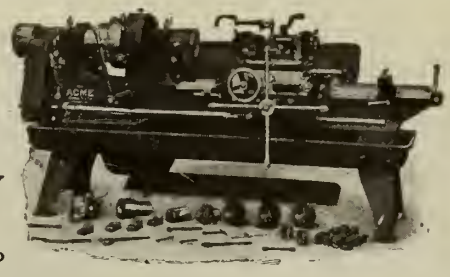
You are interested in machines built to give greater production at a lower cost. Write for fuller particulars.

In those shops which make a study of efficiency, where every detail of costs is known and only the most productive machines are used, you will find Cincinnati Acme Turret Lathes and Screw Machines.

And the reason? Cincinnati Acme machines are built to give **economy production.**

Points of Merit

Single pulley drive.
No interference of levers when lifting heavy work in or out of chuck.
Head cast solid with bed.
Permanent alignment of spindle with vees and cross slide.
All shafts in head provided with center bearings.
Renewable spindle bearings of genuine babbitt.
Centralized control.
Cross-sliding turret.
Long and narrow dove-tail guide for cross slide.
Graduated pilot and wheel.
Power cross and longitudinal feeds (reversible).
Safety stops in all directions.



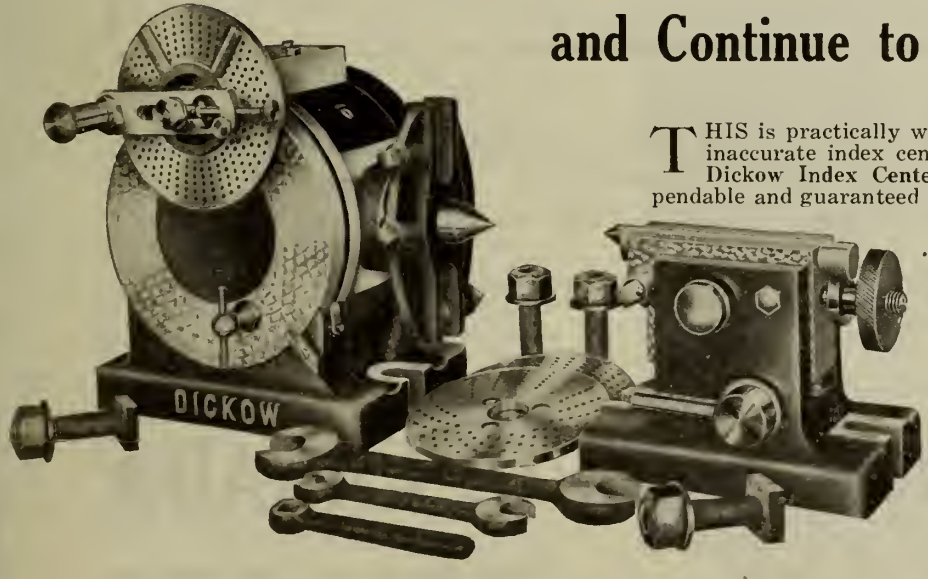
The Acme Machine Tool Company

Cincinnati, Ohio, U.S.A.

Canadian Agents: Rudel-Belnap Machinery Co., Montreal, Toronto

Why Keep Your Production Down

and Continue to Waste Money?



THIS is practically what you are doing when you use cheap, inaccurate index centers when a few dollars more will buy Dickow Index Centers! These centers are absolutely dependable and guaranteed for their high degree of accuracy. They hold over 850 pounds 22 inches from center of swivel block. This means heavier cuts and more production.

Dickow Index Centers stood the test for 14 years. Over 2,000 satisfied users all over the world. Their cost-cutting merits are appreciated as well as their efficiency. You should adopt them without delay. Decide now.

Also manufacturers of "DICKOW SUPERIOR EIGHT" PRECISION LATHES.

We can make prompt deliveries

Fred. C. Dickow Machinery Co.

3514 West Lake Street CHICAGO, ILL., U.S.A.

ACCURACY DICKOW QUALITY

If interested tear out this page and place with letters to be answered.

Open a Bank Account in Canada

THE present exchange situation between Canada and the United States is affecting trade relations between the two countries.

American exporters can meet this abnormal situation by opening Bank Accounts in Canada.



THE Royal Bank of Canada has 717 branches, of which 617 are located in Canada, and Newfoundland. The map above shows how well these branches are distributed.

Write for a complete list of branches and for terms respecting a Canadian Account.

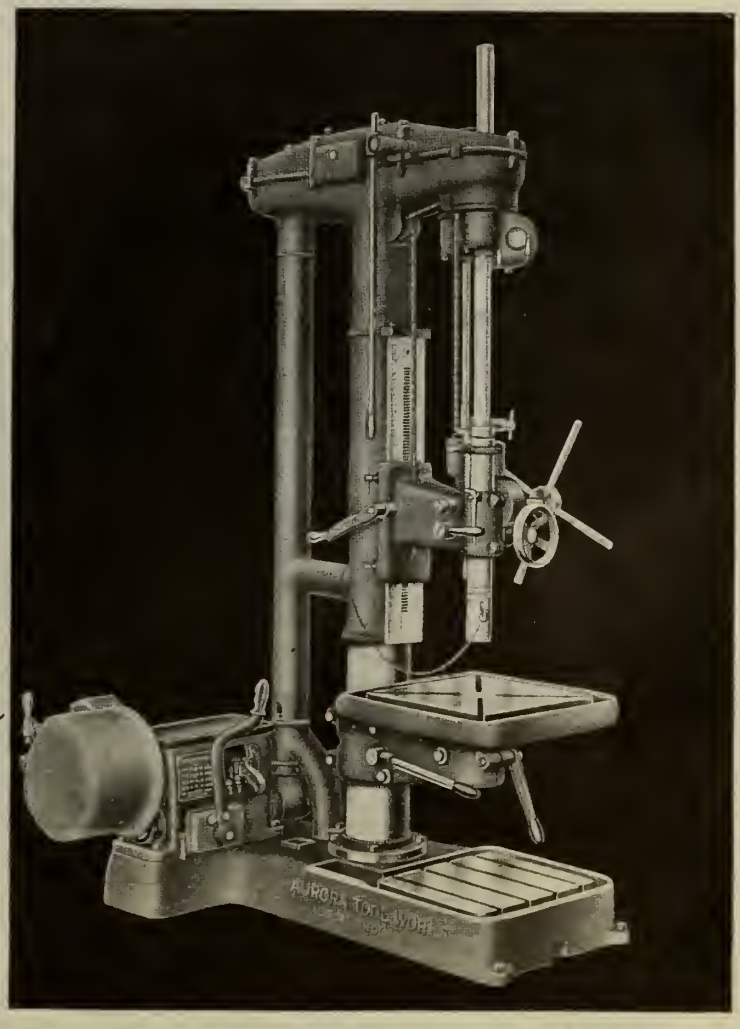
THE ROYAL BANK OF CANADA

Capital and Reserves $40,000,000 **Total Resources $595,000,000**

Head Office: **MONTREAL**

The Aurora

Rapid Production
Ease of Manipulation
Heavy Pulling Power



IT is a high-grade vertical drill embodying features that mean rapid production, ease of manipulation, heavy pulling power and accuracy throughout the life of the drill.

The enclosed construction of all moving parts—except spindle and feed rod—reduces the chance of accident, to say nothing of protecting the working parts of the machine. All bearings and gears run submerged in oil—tell-tale gauges show the oil level, avoiding danger of running dry. Every operating movement is controlled from the front; feeds and speeds are plainly shown and may be obtained without stopping the machine.

Don't order another vertical drill until you have investigated the "Aurora."

THE AURORA TOOL WORKS, Aurora, Ind.

Sales Agents:

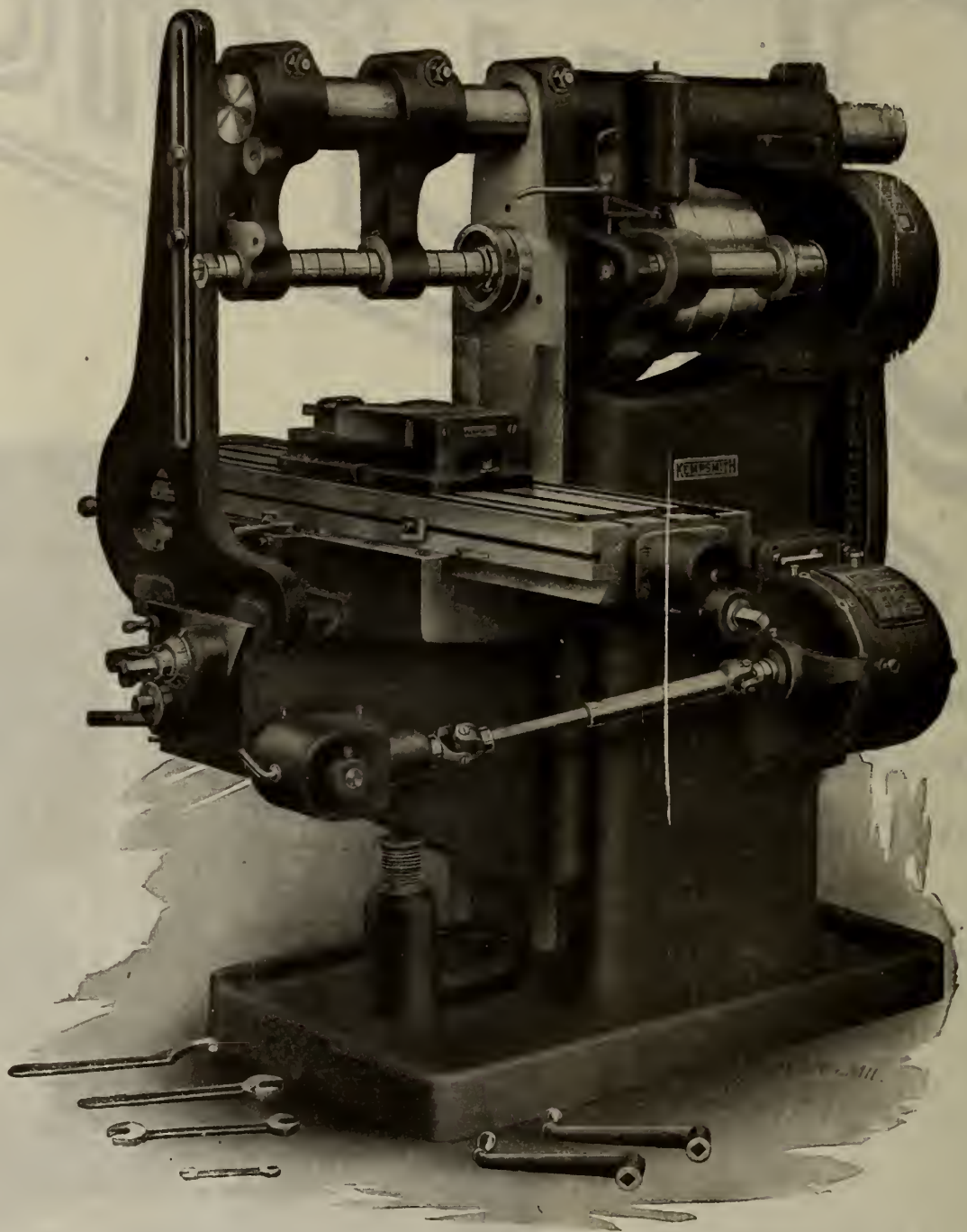
GARLOCK-WALKER MACHINERY CO., LIMITED

32 Front Street West, TORONTO

MONTREAL WINNIPEG

If interested tear out this page and place with letters to be answered.

KEMPSMITH



KEMPSMITH No. 3 Plain Milling Machine

Double Back Geared

A heavy, powerful tool with double back gears and wide driving belt running on a three-step cone of large diameter. Our catalogue "B" describes and illustrates many notable features of the Kempsmith Miller. Write for a copy to-day.

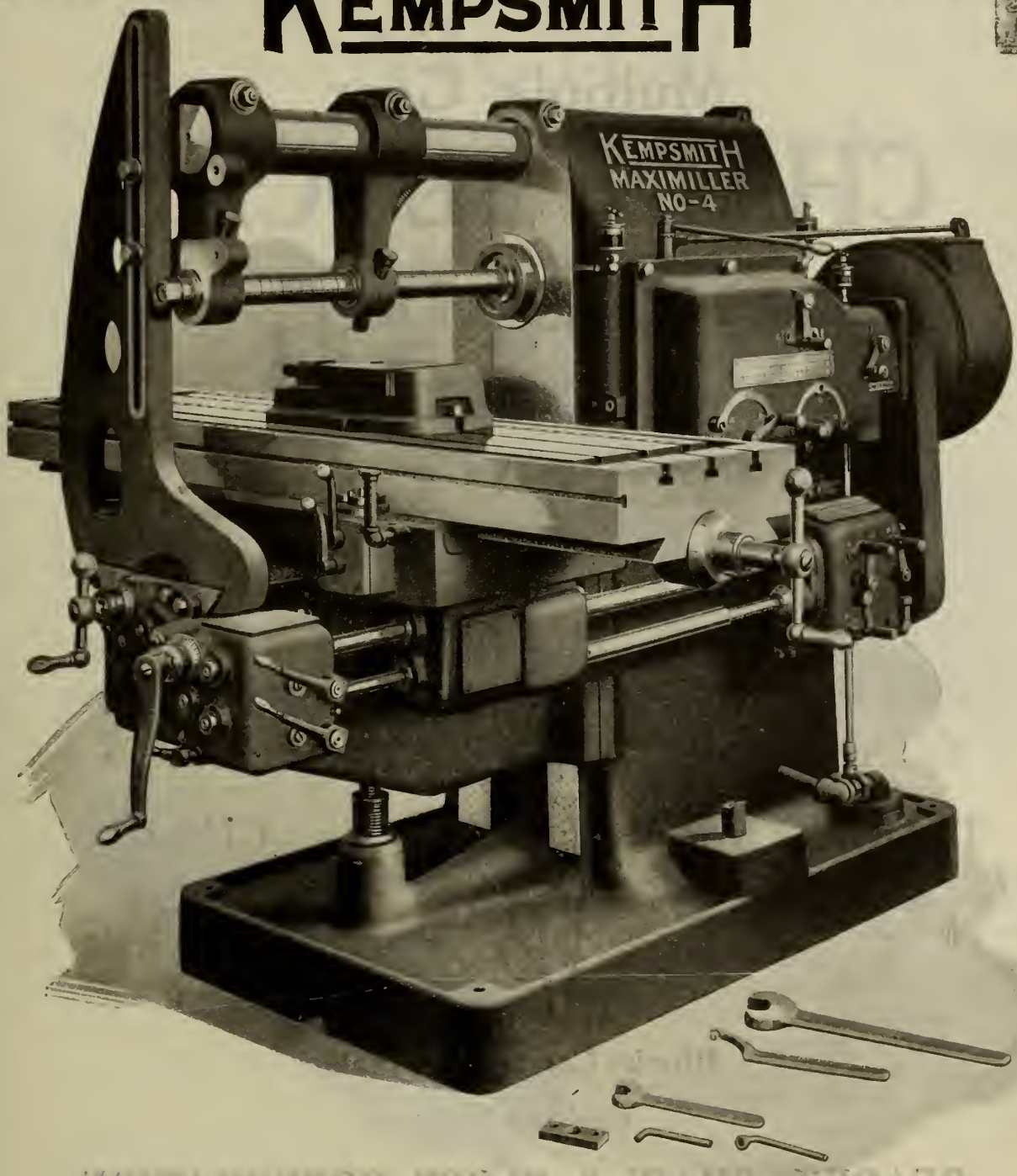
THE KEMPSMITH MANUFACTURING CO.

MILWAUKEE, WIS., U.S.A.

FOREIGN REPRESENTATIVES:—Barandiaran & Co., 3 Alameda, San Sebastian, Spain; Bevan & Edwards Pty., Ltd., 117-29 King St., Melbourne, Australia; Edgar Bloxham, 12 Rue du Delta, Paris, France; D. Drury & Co., 1-2 Central House, Main St., Johannesburg, South Africa; Nielsen & Winther, Blegdamsveg 60, Copenhagen, Denmark; Parke & Lacey Co., Ltd., 60 Clarence St., Sydney, N.S.W., Australia; Selson Engr. Co., 19 Via Botero, Turin, Italy, and 85 Queen Victoria St., London, E.C., England; Spliethoff, Beewukes & Co., Leuvehaven, W.Z., 159, Rotterdam, Holland; American Trading Co., Tokio, Japan; Alfred Herbert, Ltd., 35 Rue de Laekin, Brussels, Belgium.

CANADIAN DEALERS.—The Geo. F. Foss Machinery & Supply Co., Limited, 305 St. James St., Montreal, Canada; General Supply Co., 38 Toronto St., Toronto, Canada.

KEMPSMITH



KEMPSMITH No. 4 Plain Maximiller

A veritable maximum in milling machines embracing all Kempsmith patented features, permitting a maximum in production and efficiency. Write for particulars as to this machine.

THE KEMPSMITH MANUFACTURING CO.

MILWAUKEE, WIS., U. S. A.

FOREIGN REPRESENTATIVES:—Barandiaran & Co., 3 Alameda, San Sebastian, Spain; Bevan & Edwards Pty., Ltd., 117-29 King St. Melbourne, Australia; Edgar Bloxham, 12 Rue du Delta, Paris, France; D. Drury & Co., 1-2 Central House, Main St., Johannesburg, South Africa; Nielsen & Winther, Blegdamsveg 60, Copenhagen, Denmark; Parke & Lacey Co., Ltd., 60 Clarence St., Sydney, N.S.W., Australia; Selson Engr. Co., 19 Via Botero, Turin, Italy, and 85 Queen Victoria St., London, E.C., England; Spliethoff, Beewukes & Co., Leuvehaven, W.Z., 159, Rotterdam, Holland; American Trading Co., Tokio, Japan; Alfred Herbert, Ltd., 35 Rue de Laekin, Brussels, Belgium.

CANADIAN DEALERS.—The Geo. F. Foss Machinery & Supply Co., Limited, 305 St. James St., Montreal, Canada; General Supply Co., 38 Toronto St., Toronto, Canada.

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QUALITY *SERVICE*

Multiple Gear

CHAIN BLOCKS

READING C AND B

PRODUCTS



TRAVELING CRANES

TROLLEYS

ELECTRIC HOISTS

CHAIN

Blocks Carried in Stock

Catalog on Request

READING CHAIN & BLOCK CORPORATION

READING, PENNA., U.S.A.

Canadian Representative:

MUSSENS LIMITED

Montreal Toronto Winnipeg Vancouver

EFFICIENCY *DURABILITY*

VICTOR

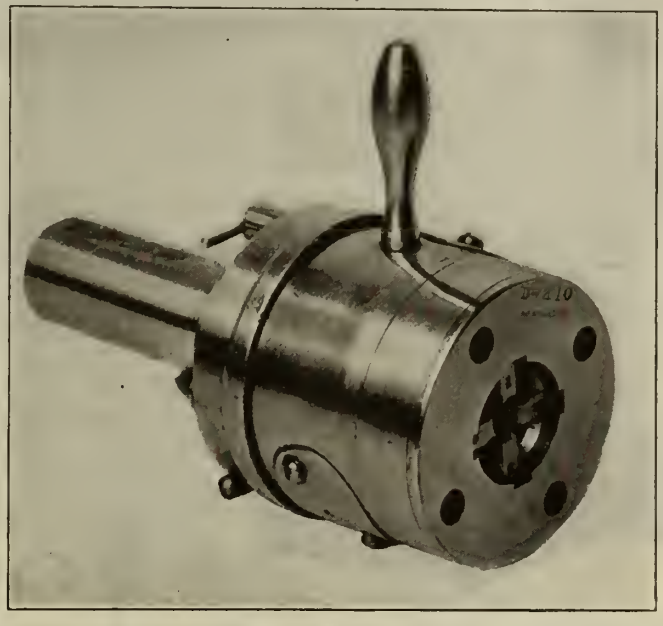
Self-Opening Die Heads—Collapsible Taps

For Clean, Smooth Threads and Lower Costs

VICTOR SELF-OPENING AND ADJUSTABLE DIE HEADS open automatically when travel of turret is stopped, or by means of an internal trip, can be adjusted to cut 1-32″ over or under size. Head is completely enclosed, no dirt can enter.

Proof of their superior service is given by the following observation of a user:

"The work done by these chasers has been so superior to anything we have had in the shape of die work that we feel like expressing ourselves so that you may feel encouraged to go further."





VICTOR ADJUSTABLE AND COLLAPSIBLE TAPS are adjustable for wear, are long lasting, and invaluable in bulk production. Released by a trigger when bottom of hole has been reached; they save time and avoid spoiled threads.

More proof of "Victor" merit:

"Two operations and half another completed in the time our old taps took to do one; that, I guess, is why we continue to use your Victor Collapsible Taps," writes an enthusiastic customer.

The Victor line of thread-cutting equipment is complete; styles and sizes to meet all needs. Write for full line of thread-cutting literature.

VICTOR TOOL COMPANY, Inc.

WAYNESBORO, PA.

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NORTHERN CRANES

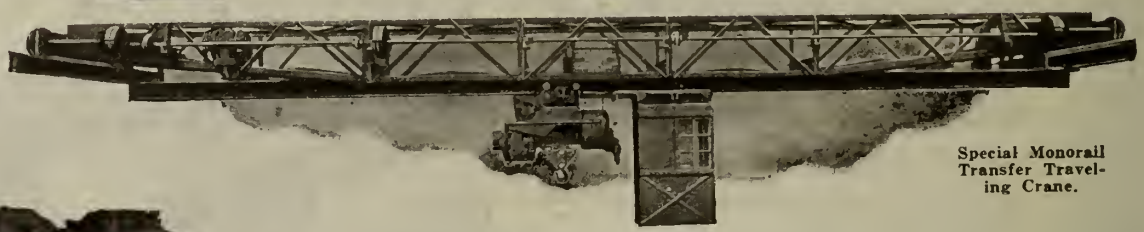
NORTHERN CRANE WORKS LIMITED
WALKERVILLE, ONTARIO



Type D Electric Hoists
½ to 10 tons.



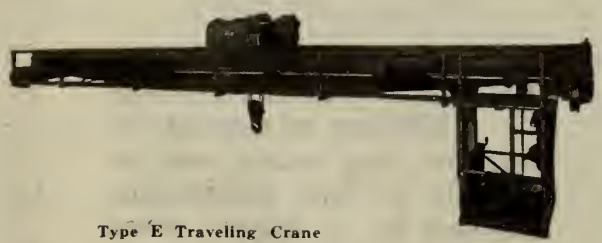
Three Motor Patent
Type E Crane



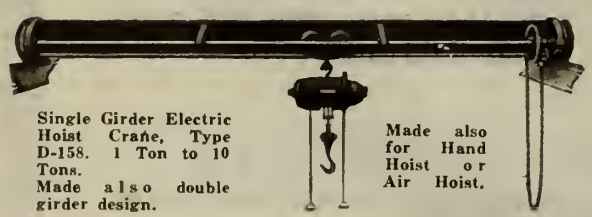
Special Monorail
Transfer Traveling Crane.



Northern Type E Crane Trolley, Rigid, Enclosed Construction. Patented in Canada.
All gears enclosed and non-overhung.



Type E Traveling Crane



Single Girder Electric Hoist Crane, Type D-158. 1 Ton to 10 Tons.
Made also double girder design.

Made also for Hand Hoist or Air Hoist.



Electric Traveling Gantry Crane with Magnet.

Reliable Cranes and Hoists

Made-in-Canada

WHY purchase imported cranes and hoists when our splendidly equipped crane plant at Walkerville will take care of your needs?

Northern Cranes are designed and constructed by men of long experience. They are modern in every detail.

The line includes Electric and Hand Cranes, Electric Hoists, Air Hoists, and Foundry Equipment. Send for catalog to-day.

NORTHERN CRANE WORKS
LIMITED
Walkerville, Ont.

THE GARVIN PAGE

Published by

THE GARVIN MACHINE CO.

Builders of Machine Tools since 1865

The end of our nose—

If the exchange of Garvin built machine tools for some of your money were our only aim, you might well say that the tip of the nose was the limit of our vision. Rest assured it is not.

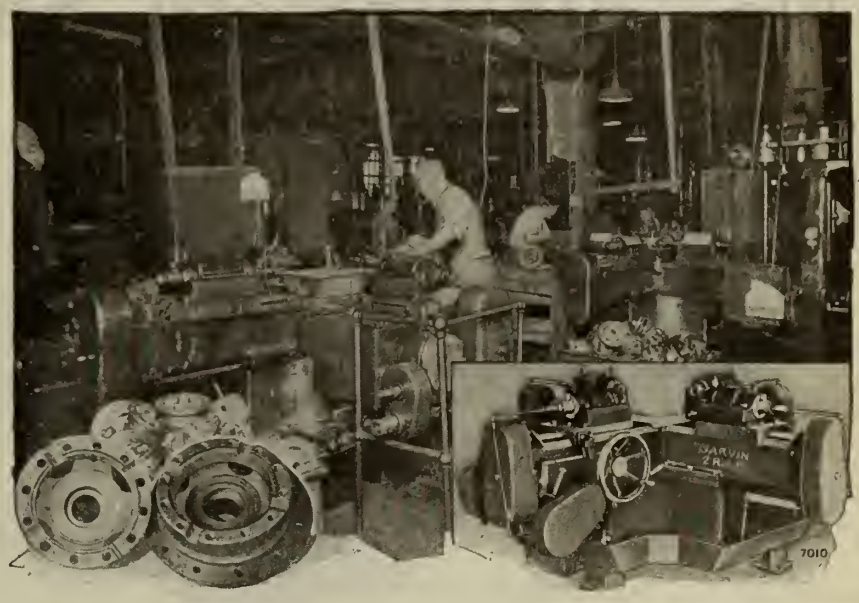
In fact we would rather have a man come to us and say, "Here's my problem—what'll I do?"

That's the real foundation of the business we've long been building, —"Service" in the way of drawing on our fund of information that has come with years of constant study.

And we are just as free to say, Mr. Man, you ought to put in a Thus and Such as we are to point out the need for a machine of our own make. We like to feel that our friends can come to us for real advice—and they do.

It doesn't cost you anything to find out about Garvin Service in the way of advice on machine shop problems—we'll feel honored at your asking.

H. R. Garvin



These Two Garvin No. 2 Four-Head Right-Angle Drilling and Turning Machines

are increasing production at the Brown-Lipe-Chapin Company's Plant

Equipped with combination drills and reamers, these Garvin No. 2 R.A.D. Four-Way Drilling Machines are drilling and reaming spider holes, 4 at a time, in differential cases. Although this is a particular job which demands accuracy, as the holes must be exactly at 90 degree angles and to within .002 limits, they have never failed to make good since installed more than 2 years ago.

These machines are ideal for manufacturing automobile differential parts. They embody a strength and accuracy, maintain their alignment, will not spring under heavy cuts and are rapid and easy to operate.

It will prove to your advantage to send for our 340-page Garvin Catalog fully describing the Garvin No. 2 R.A.D. Four-Way Drillers and our many other machines.

The Garvin Machine Co.

Spring and Varick Streets
New York, N.Y.

G-80

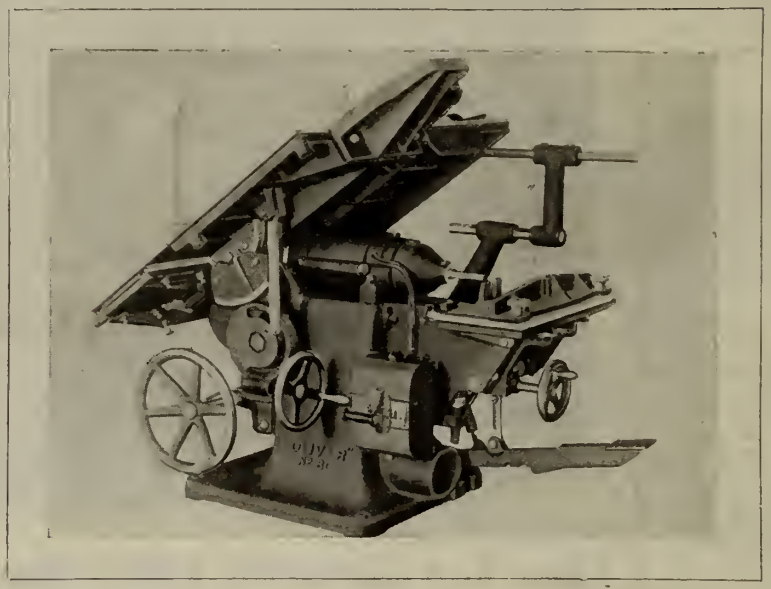
GARVIN

BUILDER OF BETTER MACHINE TOOLS

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The OLIVER
No. 80 Variety Saw Bench

Either Belt or Motor Driven



View of Self-contained Motor-on-Arbor Machine

This New Labor-Saver Commands Your Attention

IF YOU have a variety of work, the **Oliver No. 80** is the machine you should have in your shop. It will save labor, time and expense, and the fact that it is an **Oliver** is proof of its general efficiency.

The machine is designed and built strictly to meet present-day requirements in the production of variety woodwork, wood patterns, furniture, automobile bodies, carriage bodies, agricultural implements, talking machine cabinets, and other high-grade woodwork. It will do ripping, cross-cutting and dadoing quickly and efficiently. Cuts a perfect mitre and measures an angle instantly and accurately. It will cut off a length or rip to width. No calculating required to do this, neither does the operator have to refer to a rule.

The construction is rugged throughout and all necessary attachments such as mitre cut-off gauge, etc., are provided. Two types of tables can be furnished, plain and universal.

There are many other features of the **"Oliver" No. 80** you should know about. Send for complete description.

Before placing your next order for Pattern Shop Equipment, Woodworking Machinery, or Engine Lathes, you should investigate the "Oliver" line.

Oliver Machinery Co., Grand Rapids, Mich.

BRANCHES: New York, Chicago, St. Louis, Los Angeles, San Francisco, Seattle, Salt Lake City, Denver, Phoenix, Manchester, Eng.

SHAPERS

12″, 14″, 16″ plain crank; 16″, 20″, 25″ back geared crank, either cone driven or through speed box as shown.

28″ and 28-32″ back geared crank, single pulley drive.



The Smith & Mills Co.

Cincinnati, Ohio
U.S.A.

Canadian Agents: Geo. F. Foss Machinery & Supply Co., Ltd., Montreal. A. R. Williams Machinery Co., Ltd., Toronto, Ontario, and St. John, N.B.

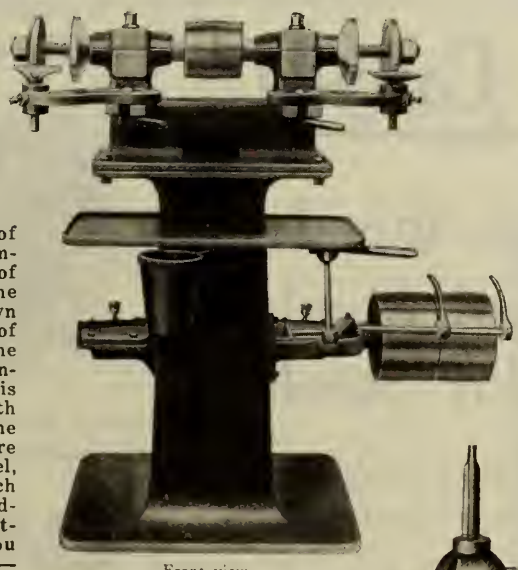
SAINT LOUIS

Self-Contained

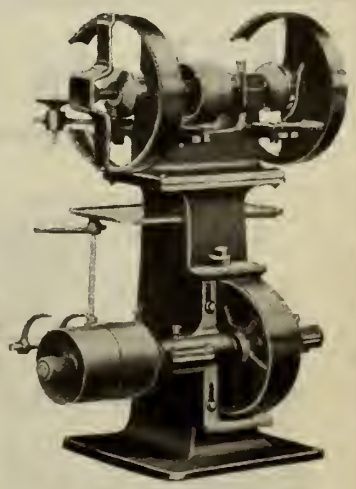
Countershaft Grinder



SMOOTH running of wheels is an important advantage of these grinders. The belt strain being down against the body of the machine gives the wheels a smooth-running motion, which is impossible to get with this class of machine belted up. Arbors are of 40% carbon-steel, thread two-pitch coarser than standard. **Has other profitable advantages you should know about — send for full description.**



Front view



The Saint Louis line is carried in stock by leading dealers in Canada, England, France, South Africa, New Zealand, and Japan.



SAINT LOUIS TAPPING MACHINE

Actuated by foot; both hands being free to handle work makes this machine a rapid producer. Made in two vertical sizes, and one horizontal size.

Saint Louis Tapping Chuck—all steel and bronze. Very durable. Four sizes.

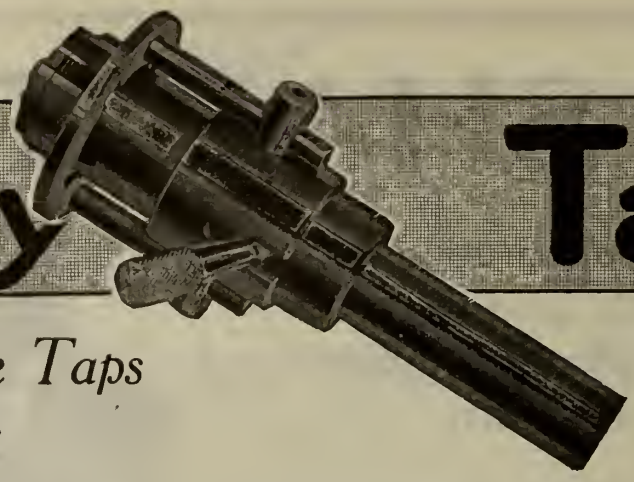
SAINT LOUIS MACHINE TOOL CO., ST. LOUIS, U.S.A.

For Sale by The Canadian Fairbanks-Morse Company Limited

FAIRBANKS-MORSE QUALITY F M 100%

If interested tear out this page and place with letters to be answered.

Murchey Taps



Murchey Collapsible Taps Never Strip Threads

As soon as the tap is tripped, the chasers collapse—and the stress of the heaviest work will not make them collapse before the proper time.

The chasers are adjustable to compensate for any wear, thus enabling the tap to maintain its minute accuracy.

For convenient, quick-acting operation and general all-round dependability, use Murchey Collapsible Taps. They are built for service —and they give it.

The Coats Machine Tool Co., Ltd., Caxton House, Westminster, London, S. W., England. Fenwick Freres & Co., 16 Rue Fenelon, Paris, France.

Murchey Machine & Tool Co., 75 Porter Street, Detroit, Mich.

Made In Canada

L-XX High-Speed
ATLAS Tool Steels
ATLAS Alloy Steels

Hot Rolled, Forged Blocks and Discs
Cold Drawn Steel and Drill Rod

CANADIAN ATLAS CRUCIBLE STEEL CO.
LIMITED

GENERAL SALES OFFICE:
133 Eastern Avenue, TORONTO, ONT.
Works: WELLAND, ONT.
Sales Offices and Warehouses:
TORONTO, ONT. MONTREAL, QUE. WINNIPEG, MAN.

Canadian Steel Foundries Need Frost Improved Sand Mills



WINNING FEATURES

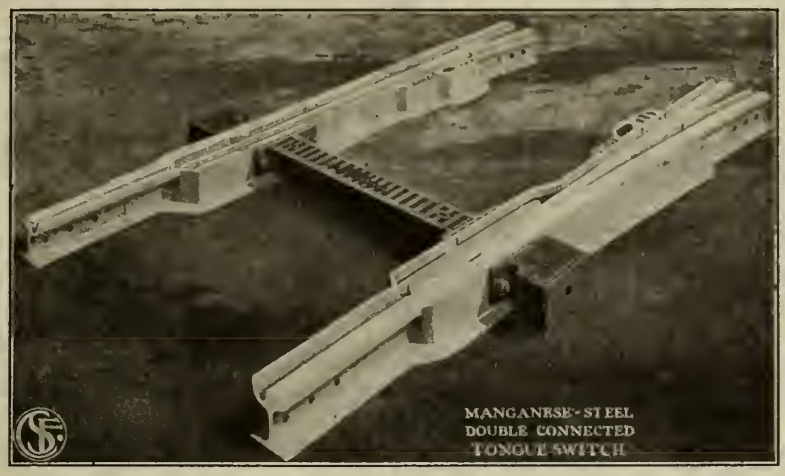
Heavy Mullers
Unloading Device
Motor or Belt Drive

The Frost Mfg. Co.
112 W. Adams St., Chicago

OAKITE CLEANS

Put your Cleaning Problems up to us.

OAKLEY CHEMICAL CO
44 THAMES STREET · NEW YORK



MANGANESE STEEL TRACKWORK

for

Steam and Electric Railways

Manufacturers of Balkwill Articulated Manganese-Steel Crossings

CANADIAN STEEL FOUNDRIES LIMITED

Transportation Building, Montreal

PACKINGS



Take packings—rod and sheet—away from the industries, and even the most inexperienced knows what would happen.

With the operation of practically all kinds of plants, factories, mills, etc., so utterly dependent on rod and sheet packings to allow proper operation, why use any but thoroughly reliable and well-known products?

DANIEL'S P. P. P. ROD PACKING

Probably the best known rod packing on the market. Unequalled for the packing against steam, water, air, ammonia, and other fluids.

Many practical tests by experienced engineers under various conditions have clearly demonstrated that P.P.P. is the most economical rod packing to use. Its long life is remarkable, its ability to create a saving in the fuel bill is well known.

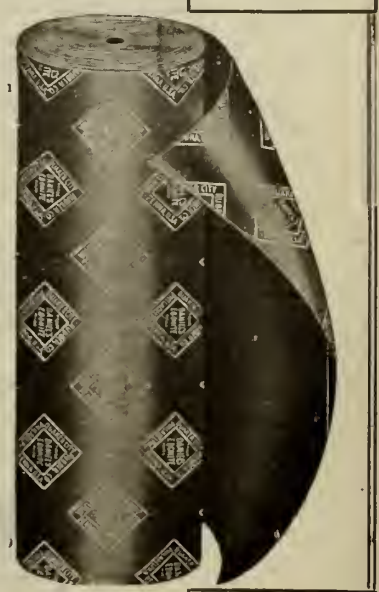
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Premier Meighen Discusses National Issues in MACLEAN'S

The Rt. Hon. Arthur Meighen, Prime Minister of Canada, has written for January 1st MACLEAN'S a forceful exposition of his platform and policy.

HE discusses the bi-lingual issue, the tariff, reconstruction, the growing unrest and unemployment — but he avers that the tariff is the "one great issue of our domestic politics?

"Why is it the issue?" queries Mr. Meighen. "It is the issue, I think, because the enemies of the Government cannot oppose us on any other."

Regarding the tariff, the Premier tells readers of MACLEAN'S: "We do not propose going any higher *on any single line of articles.*"

"Is Mr. Crerar hedging?" the Premier inquires.

Of Mr. Mackenzie King he says: "He can be quoted on almost every conceivable side of the tariff issue."

Articles by Mr. W. L. Mackenzie King and Mr. T. A. Crerar will follow in succeeding issues.

"The Drama of Our Great Forests"

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Other Big Features

"The Big Time Man."
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"Money and Motion Pictures."
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A Canadian who filmed "The Miracle Man."

"The Diamond Pickers."
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The girl detective finds how diamonds disappear by extra-human agency.

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By Kathrene and Robert Pinkerton.
A Hudson's Bay story, where the Indian outwits his white foe.

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By Col. Geo. H. Ham.
Anecdote after anecdote of the past fifty years in Toronto.

"Margot and Peter Flower."
By Mrs. "Margot" Asquith.
The commencement and course of an amazing eight years' flirtation.

Review of Reviews

Selections culled and clipped from the cream of the world's periodical literature.

"How France is Recovering"—Lovat Fraser.
"Germany Still Unrepentant"—J. Ellis Barker.
"Winston's Opinion"—Rt. Hon. Winston Churchill.
"Women Rule Films"—W. Stephens Bush.
"Wells on Mankind"—H. G. Wells.
"Bethmann-Hollweg Explains"—A. J. Toynbee.
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Beatty Bros., Limited, Fergus, Ontario, with branches throughout Canada in a recent issue of their weekly sales bulletin, "Facts," give a very clear idea of the value of Hardware and Metal to the Canadian trade. This is what "Facts" has to say:—

"Do You Read Hardware & Metal?"

"We do not often take space in FACTS to boost any particular paper, but we are making an exception in the case of Hardware and Metal.

"If we did not know that so many of our hardware salesmen subscribed to it, we should be tempted to republish in FACTS some of their recent articles on the price situation.

"Some ten or fifteen trade papers—as distinct from farm papers—come into the FACTS editorial sanctum. There is none with half the weight and breadth of information that is possessed by Hardware and Metal.

"During the easier days of the past few months,—when the main question was not what the Sales Force could sell but what the Factory could supply—we may have been tempted to let Hardware and Metal go by the board.

"You can't afford to neglect it in these days. It is just full of authoritative information on the price situation in particular and hardware merchandising in general.

"So read it carefully. It gives you just the dope you need. When you tell the merchant that prices are not going to slump—well, he may not quite believe you. He feels you may have some axe to grind.

"But when you can quote or indicate some article in Hardware and Metal to prove your point,—it convinces.

"Remember, Hardware and Metal carries a lot of weight. It is known to be thoroughly unprejudiced and reliable. There are very few stronger trade papers in America so far as their own particular fields are concerned.

"So don't neglect your weekly reading of Hardware and Metal. Clip out any specially good points and paste them in your notebook for easy reference.

"The first two or three items on page 40 of the October 23 issue are dandies—probably you noticed them. If not, turn up your copy and read them.

"We all have to be well posted in these days or we go under. This is no time for the half-informed salesman to be on the road."

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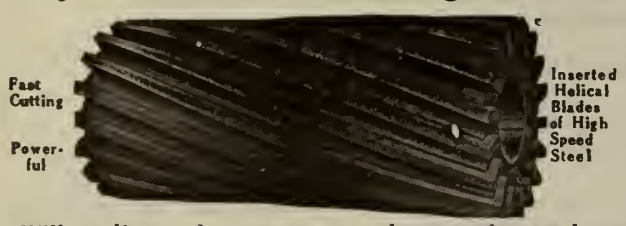
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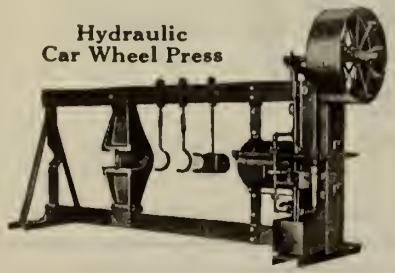
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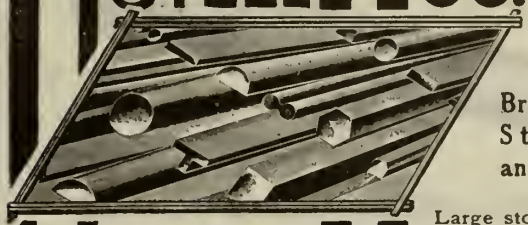
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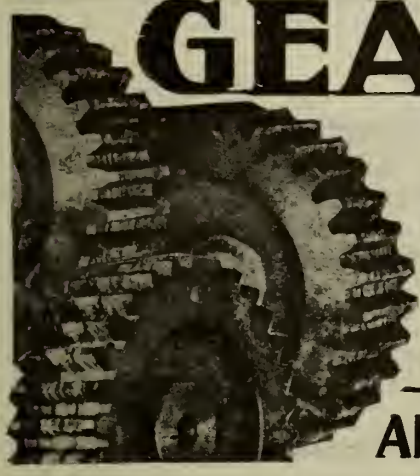
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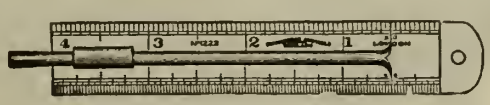
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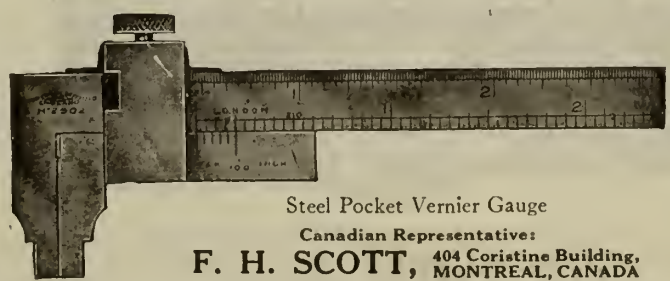


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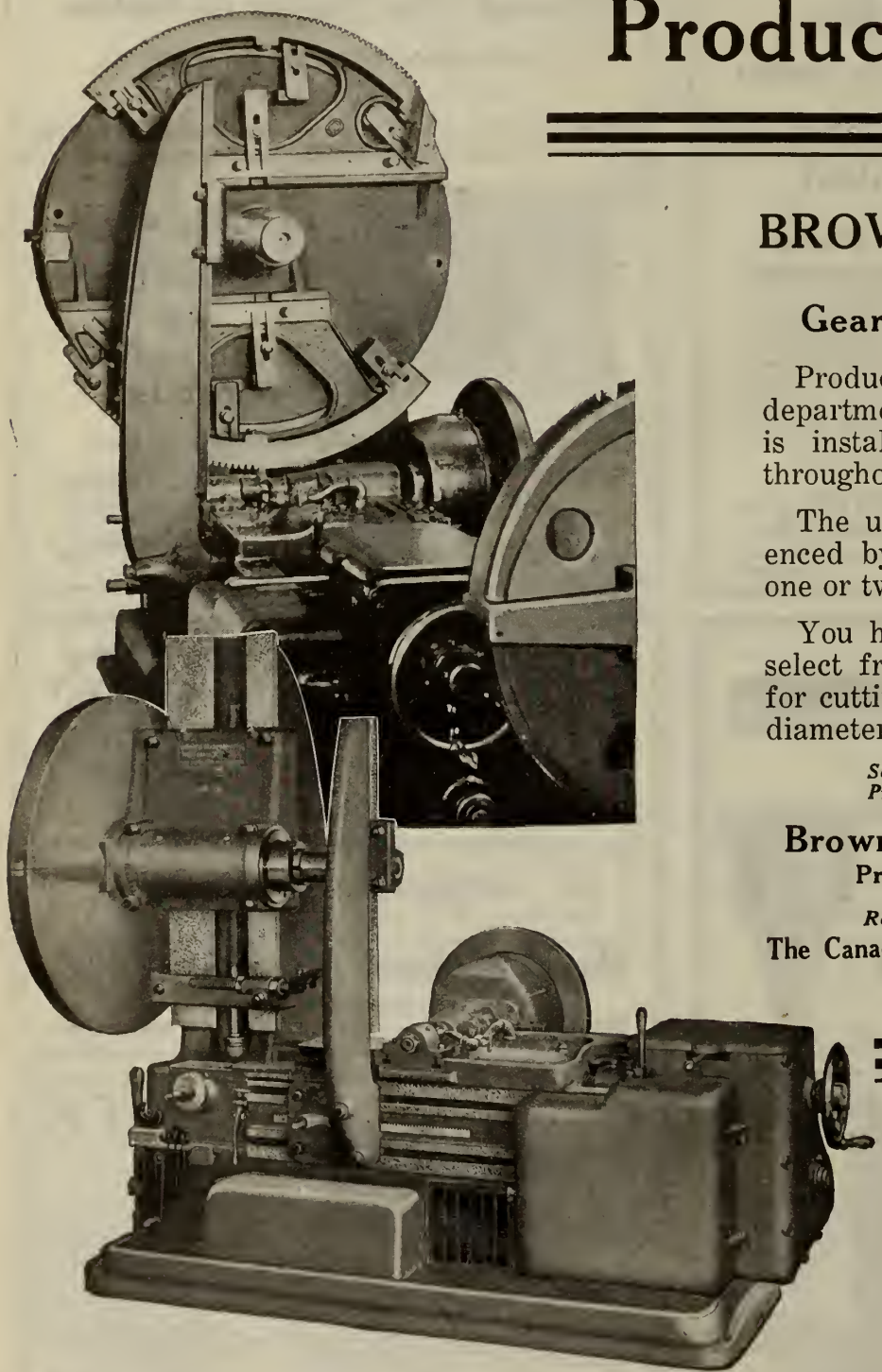
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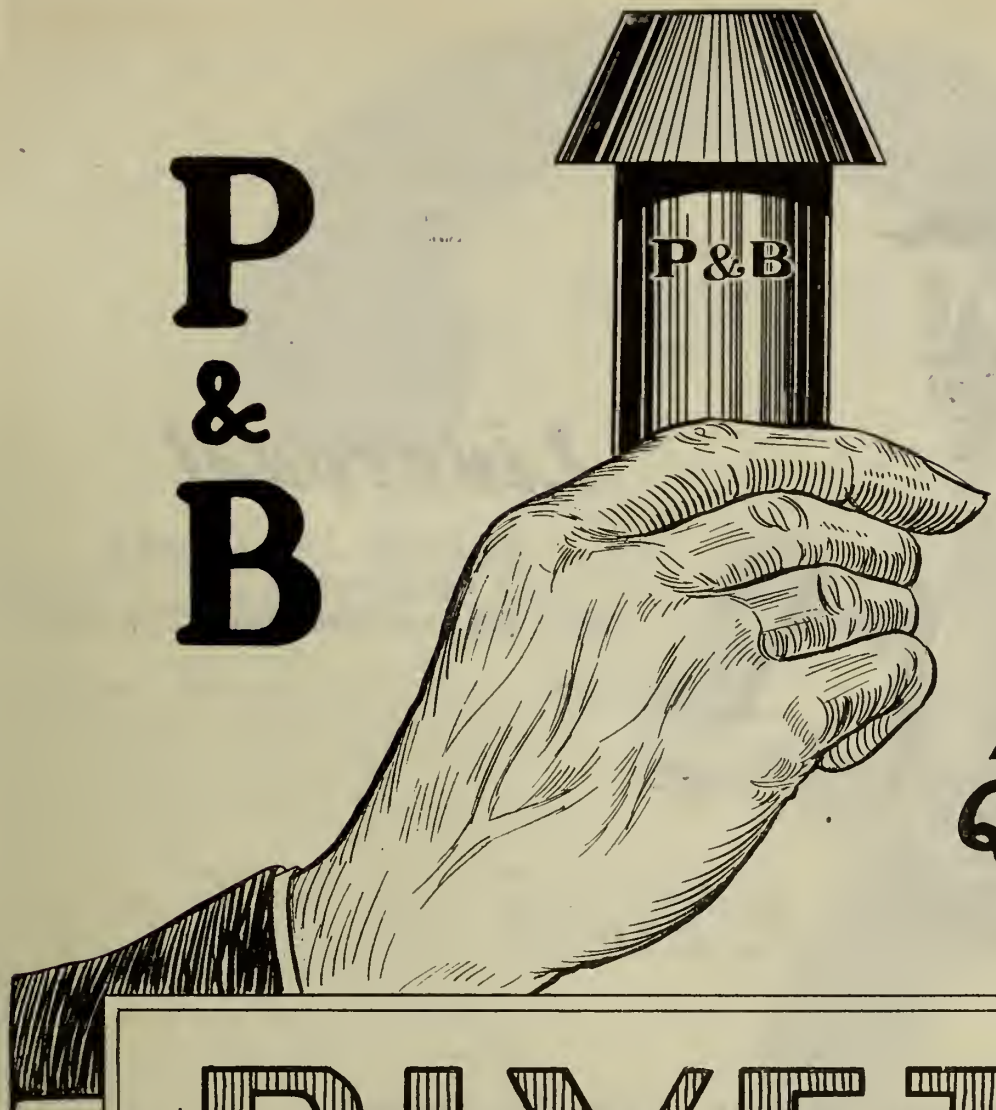
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Belt Dressings and Fillers
Alkenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.

Belt Fasteners
Can. Consolidated Ruhber Co., Ltd., Montreal, Que.
Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Lacing
Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing Machines
Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belt Tools
Graton & Knight Mfg. Co., Worcester, Mass.

Belting, Chain
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tuhe & Supply Co., Montreal, Que.
Morse Chain Co., Ithsca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Belting, Fabric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Goodyear Tire & Ruhber Co. of Can., Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Sumner & Co., New York City.

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairhanks-Morse Ltd., Montreal. Q.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Goodhue J. L. & Co., Danville, Que.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Scheiren Co., Chas. A., New York City
Smith Belting Co., Toronto, Ont.
Sumner & Co., New York City.
Tullis & Son, Ltd., John, Glasgow, Scot.

Belting, Rubber
Can. Consolidated Ruhber Co., Ltd., Montreal, Que.
Dunlop Tire & Ruhber Goods Co., Ltd., Toronto, Ont.
Gutts Percha & Rubber, Toronto, Ont.
Quaker City Rubber Co., Philadelphia, Pa.

Belts, Abrasive
Carborundum Co., Niagara Falls, N.Y.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ryerson & Son, Jos. T., Chicago, Ill.
Williams Machinery Co., A. R., Toronto, Ont.

Bins, Ore
MacKinnon Steel Co., Sherbrooke, Que.

Blocks
Ford Chain Block Co., Philadelphia, Pa.
Wright Mfg. Co., Lishon, Ohio.

Blocks, Chain (See Hoists, Hand)
Aikenhead Hardware Ltd., Toronto, Ont.
Ford Chain Block Co., Philadelphia, Pa.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atiaa Crucihle Steel Co., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
fillingsworth Steel Co., John, New York City, N.Y.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
General Combustion Co. of Can., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sturtevant Co., B. F., Boston, Mass.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Victor Tool Co., Waynesboro, Pa.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
London Bolt & Hinge Works, London, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

Bolt Threading Die Heads
Landis Machine Co., Inc., Wayneshoro, Pa.

Boosters
Sturtevant Co., B. F., Boston, Mass.

Boring and Turning Mills, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.

Boring, Drilling and Milling Machines, Horizontal
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Lucas Machine Tool Co., Cleveland, Ohio.
Universal Boring Machine Co., Hudson, Mass.

Boring, Drilling and Milling Mach., Vertical
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Lucas Machine Tool Co., Cleveland, Ohio.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Universal Boring Machine Co., Hudson, Mass.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont.

Boring Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

Box Strapping (Signal System)
Transportation Service Ltd., Toronto, Ont.

Brackets, Lamp Adjustable
McCroskey Tool Corp., Meadville, Pa.

Brakes, Magnetic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Brass
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.

Bricks, Fire
Elk Firebrick Co. of Can., Ltd., Hamilton, Ont.

Bridges
Hamilton Bridge Works Co., Ltd., Hamilton, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

Broaching Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.

Bronze
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Walker & Sona Metal Products, Ltd., Hiram, Walkerville, Ont.

Bronze, Phosphor
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

Bulldozers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ryerson & Son, Jos. T., Chicago, Ill.

Burners, Oil and Gas
Can. Hauck Burner Co., Port Hope, Ont.
General Combustion Co. of Can., Ltd., Montreal, Que.
Rockwell Co., W. S., New York City.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Goodell & Pratt Co., Greenfield, Mass.
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

Cars, Ore
MacKinnon Steel Co., Sherbrooke, Que.

BUYERS' DIRECTORY

Castings, Aluminum
Canada Electric Castings Co., Ltd., Orillia.
Canada Metal Co., Ltd., Toronto, Ont.
Electric Steel & Engineering Co., Welland, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Electric Castings Co., Ltd., Orillia.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Electric Steel & Engineering Co., Welland, Ont.
International Machinery & Supply Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que.

Castings, Die Molded
Electric Steel & Engineering Co., Welland, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Katie Foundry Co., Galt, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bernard Industrial Co., A., Fortierville, Que.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Electric Castings Co., Ltd., Orillia.
Electric Steel & Engineering Co., Welland, Ont.
Fleck Ltd., Alexander, Ottawa, Ont.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que.

Castings, Nichrome
Can. Driver-Harris Co., Walkerville, Ont.
Electric Steel & Engineering Co., Welland, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Castings, Semi-Steel
Davidson Mfg. Co., Thos., Montreal, Que.
Electric Steel & Engineering Co., Welland, Ont.
Halcomb Steel Co., Syracuse, N.Y.
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Mantitoba Steel Foundries, Ltd., Winnipeg, Man.

Castings, Steel
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Swedish Crucible Steel Co. of Can., Ltd., Windsor, Ont.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Reading Chain & Block Co., Reading, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chemists
Toronto Testing Laboratory, Toronto, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Alkenhead Hardware Ltd., Toronto, Ont.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Goodell & Pratt Co., Greenfield, Mass.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McCroskey Tool Corp., Meadville, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Alkenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Columbia Hdwe. Division, Cleveland, O.
Dickow, Fred C., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.
Levis, The, Toronto, Canada.
Scythes & Company, Ltd., Toronto, Ont.

Clocks, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Clutches, Friction
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Positive Clutch & Pulley Works, Toronto, Ont.

Coal and Ash Handling Machinery
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compressors, Air
Curtis Pneumatic Machinery Co., St. Louis, Mo.

Compressors, Air and Gas
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.
Main Belting Co. of Can., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Copper
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.

Cotter Pins
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Alkenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.

Couplings, Flexible
Holden Co., Ltd., Montreal, Que.

Couplings, Rigid
Bernard Industrial Co., A., Fortierville, Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepherd Electric Crane & Hoist Co., Montour Falls, N. Y.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Reading Chain & Block Co., Reading, Pa.
Shepherd Electric Crane & Hoist Co., Montour Falls, N. Y.

Crank Pin Turning Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Flue
Holden Co., Ltd., Montreal, Que.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Madison Mfg. Co., Muskegon, Mich.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Milling Machine Co., Cleveland.
Elliott & Whitehall Tool Co., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser & Co., Inc., S. F., Fort Wayne, I.
Cataract Refining Co., Toronto, Ont.

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Turner Brass Works, Sycamore, Ill.
Union Carbide Co. of Can., Welland, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond, Carbon and Bortz
Joyce-Koebel Co., Inc., New York, N.Y

Diamond Tools
Alkenhead Hardware Ltd., Toronto, Ont.
Can. Desmond-Stephan Co., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Detroit, Mich.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt.
Walcott Lathe Co., Jackson, Mich.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Dyrab Steel (Consolidated) Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo, Ohio

Dies, Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Kimber & Hillier Mfg. Co., St. Catharines, Ont.

Dies, Self-Opening, Adjustable
Geometric Tool Co., New Haven, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.

BUYERS' DIRECTORY

Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Diac Cement
Ittichey Supply Co., Toronto, Ont.
Wausau Abrasives Co., Chicago, Ill.

Dividing Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Carborundum Co., Niagara Falls, N.Y.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Joyce-Koebel Co., Inc., New York, N.Y.
Norton Co. of Can., Ltd., Hamilton, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Aikenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drill Speeders
Canada Machinery Corp., Galt, Ont.

Drilling Machine Heads
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic
Hoosier Drilling Mach. Co., Goshen, Ind.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench
Beacon Engineering Co., Tipton, England.
Can. Blower & Forge Co., Ltd., Kitchener.
Goodell & Pratt Co., Greenfield, Mass.
Henry & Wright Mfg. Co., Hartford, Conn.
High Speed Hammer Co., Rochester, N.Y.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)
Avery Drilling Machine Co., Cincinnati, Ohio.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Holly, R. S., Toronto, Ont.
Lucas Machine Tool Co., Cleveland, Ohio.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Multiple Spindle
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.
Terry & Co., John C., Birmingham, Eng.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Drilling Machines, Portable
Haskins Co., R. G., Chicago, Ill.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Mueller Machine & Tool Co., Cincinnati, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Ryerson & Son, Jos. T., Chicago, Ill.
Toomey Inc., Frank, Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Avery Drilling Machine Co., Cincinnati, Ohio.
Beacon Engineering Co., Tipton, England.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
High Speed Hammer Co., Rochester, N.Y.
Hoosier Drilling Mach. Co., Goshen, Ind.
Jones & Shipman, of Leicester, England, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Stelnle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Aurora Tool Works, Aurora, Ind.
Avery Drilling Machine Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Hoosier Drilling Mach. Co., Goshen, Ind.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Terry & Co., John C., Birmingham, Eng.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Jones & Shipman, of Leicester, England, Toronto, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
International Machinery & Supply Co., Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sheffield Twist Drill & Steel Co., Sheffield, Eng.
Taylor Tool Co., J. A. M., Toronto, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.
Sturtevant Co., B. F., Boston, Mass.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Main Belting Co. of Can., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Emery Cloth
Wausau Abrasives Co., Chicago, Ill.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Carborundum Co., Niagara Falls, N.Y.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
International Machinery & Supply Co., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.

Enginea, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.

Expanders, Tube
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Northern Electric Co., Montreal, Que.
Sturtevant Co., B. F., Boston, Mass.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fibre
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que

File Handles
Ingersoll File Co., Ltd., Ingersoll, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Ingersoll File Co., Ltd., Ingersoll, Ont.
International Machinery & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Nicholson File Co., Port Hope, Ont
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont.
Haskins Co., R. G., Chicago, Ill.

Flux, Galvanizing
British Smelting & Refining Co., Ltd., Montreal, Que.

Fluxes, Welding
L'Air Liquide Society, Toronto, Ont.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot.

Forginga, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

Forginga, Hammer
Canada Foundries & Forgings Co., Welland, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.

Foundry Equipment
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Rice Lewis & Son, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Fuel Oil Burning Syatem
Cole Ltd., George W., Toronto, Ont.
General Combustion Co. of Can., Ltd., Montreal, Que.

Furnaces, Electric
Electric Furnace Construction Co., Philadelphia, Pa.
General Combustion Co. of Can., Ltd., Montreal, Que.

Furnaces, Heat Treating Coal
General Combustion Co. of Can., Ltd., Montreal, Que.
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Bellevue Industrial Furnace Co., Detroit.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
General Combustion Co. of Can., Ltd., Montreal, Que.
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furnaces and Ovens, Electric
Electric Furnace Construction Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furnaces, Tempering and Annealing
Brown & Sharpe Mfg. Co., Providence, R.I.
Electric Furnace Construction Co., Philadelphia, Pa.
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furniture, Machine Shop
Garlock-Walker Mchy. Co., Toronto, Ont.
Ministry of Munitions, London, Eng.
National Engineering Co., Sarnia, Ont.

Gages, Dial
Herbert Ltd., Alfred, Toronto, Ont.
Johansson Inc., C. E., Windsor, Ont.
Perdue, W. B., San Francisco, Calif.
Starrett Co., L. S., Athol, Mass.

Gages, Measuring (See Tool Work)
Chesterman & Co., Ltd., J., Sheffield, Eng.
Crescent Machine Co., Ltd., Montreal, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont.
Republic Flow Meters Co., Toronto, Ont.

Gages, Snap, Thread and Cylindrical
Ackworthie, Ltd., John, Birmingham, Eng.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, I.
Elliott & Whitehall Tool Co., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.

BUYERS' DIRECTORY

Gages, Thread
Ackworthle, Ltd., John, Birmingham, Eng.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

Garnet, Emery and Flint Paper and Cloth
Ritchey Supply Co., Toronto, Ont.
Wausau Abrasives Co., Chicago, Ill.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Prest-O-Lite Co. of Can., Toronto, Ont.

Gaskets
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Durabla Manufacturing Co., New York.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Smooth Mfg. Co., Jersey City, N.J.
Voorhees Rubber Co., Jersey City, N.J.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Philadelphia Gear Works, Philadelphia, Pa.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providonce, R.I.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Philadelphia Gear Works, Philadelpbia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.
Philadelphia Gear Works, Philadelphia, Pa.

Gears, Machine Moulded
Can. Steel Foundries, Montreal, Que.

Gears, Rawhide (See Gears, Cut)
Philadelphia Gear Works, Philadelphia, Pa.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Holden Co., Ltd., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Goggles, Safety
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Standard Optical Co., Geneva, N.Y.
Willson Goggles, Inc., Reading, Pa.

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd., Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.
Cateract Refining Co., Toronto, Ont.

Grinding Discs
Ritchey Supply Co., Toronto, Ont.
Wausau Abrasives Co., Chicago, Ill.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Grinding Machines, Abrasive Belt
Beacon Engineering Co., Tipton, England.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
St. Louis Machine Co., St. Louis, Mo.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Cowan & Company, of Galt, Ltd., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Goodell & Pratt Co., Greenfield, Mass.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Manbattan Machine & Tool Works, Grand Rapids, Mich.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co., Waltham, Mass.
Terry & Co., John C., Birmingham, Eng.
St. Louis Machine Co., St. Louis, Mo.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Cutter and Reamer
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Manhattan Machine & Tool Works, Grand Rapids, Mich.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Beacon Engineering Co., Tipton, England.
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Floor and Tool
Beacon Engineering Co., Tipton, England.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.
Wilkinson & Kompass, Hamilton, Ont.

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Manhattan Machine & Tool Works, Grand Rapids, Mich.

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Carborundum Co., Niagara Falls, N.Y.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto Ont.
Haskins Co., R. G., Chicago, Ill.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Wilkinson & Kompass, Hamilton, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Garlock-Walker Mchy. Co., Toronto, Ont.
La Salle Tool Co., Ltd., La Salle, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Wilkinson & Kompass, Hamilton, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Greenfield Machine Co., Greenfield, Mass.
Jones & Shipman, of Leicester, England, Toronto, Ont.
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Works, Grand Rapids, Mich.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co., Waltham, Mass.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Carborundum Co., Niagara Falls, N.Y.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
International Machinery & Supply Co., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.

Guards, Machinery and Window
Can. Wire & Iron Goods Co., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Ackworthie, Ltd., John, Birmingham, Eng.
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Garlock-Walker Mchy. Co., Toronto, Ont.
Goodell & Pratt Co., Greenfield, Mass.
Lyman Tube & Supply Co., Montreal, Que.
McKenzie Machinery Co., Guelph, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canada Machinery Corp., Galt, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Ryerson & Son, Jos. T., Chicago, Ill.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bradley & Son, Inc., C. C., Syracuse, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
High Speed Hammer Co., Rochester, N.Y.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Ryerson & Son, Jos. T., Chicago, Ill.

Hammers, Rivetting
Cleveland Pneumatic Tool Co., Toronto, Ont.
Ryerson & Son, Jos. T., Chicago, Ill.

Hangers, Shafting
Can. Link-Belt Co., Toronto, Ont.
Canadian SKF Co., Toronto, Ont.
Chapman Double Ball Bearing Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Terry & Co., John C., Birmingham, Eng.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hardening, Case-Hardening and Tempering
Hamilton Gear & Machine Co., Toronto, Ont.

Hardness Testing Apparatus
Shore Instrument Co., Jamaica, N.Y.

Hobbing Machines
Barber-Colman Company, Rockford, Ill.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Barber-Colman Company, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Reading Chain & Block Co., Reading, Pa.
Shepberd Electric Crane & Hoist Co., Montour Falls, N. Y.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Hose, All Kinds
Quaker City Rubber Co., Philadelphia, Pa.

Hose, Flexible
Gutta Percha & Rubber, Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Foamite Firefoam Co., Hamilton, Ont.

Hose, Steam, Suction, Water
Quaker City Rubber Co., Philadelphia, Pa.

Hose, Steel
International Machinery & Supply Co., Montreal, Que.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Hospital Supplies
Hartz, J. F. Co., Toronto, Ont.
Ingram & Bell, Ltd., Toronto, Ont.

Hydraulic Leather
Graton & Knight Mfg. Co., Worcester, Mass.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

Jacks, Hydraulic
International Machinery & Supply Co., Montreal, Que.
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Jigs and Fixtures (See Tool Work)
Bilton Machine Co., Bridgeport, Conn.
Burgess & Marchand, Montreal, Que.
Crescent Machine Co., Ltd., Montreal, Q.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Itapid Tool & Machine Co., Lachine, Que.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Elliott & Whitehall Tool Co., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Toomey Inc., Frank, Philadelphia, Pa.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lacing Leather
Clipper Belt Lacer Co., Grand Rapids, Mich.
Main Belting Co. of Can., Montreal, Que.

BUYERS' DIRECTORY

Ladders, Permanent
Can Foamite Firefoam Co., Hamilton, Ont.

Lamps, Electric
Federal Engraving Co., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Pans, Portable
Canada Machinery Corp., Galt, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundaa, Ont.
Canada Machinery Corp., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
McKenzie Machinery Co., Guelph, Ont.
Porter-Cable Machine Co., Syracuse, N.Y.
Ryerson & Son, Jos. T., Chicago, Ill.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundaa, Ont.
Canada Machinery Corp., Galt, Ont.
Cowan & Company, of Galt, Ltd., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Lehmann Machine Co., St. Louis, Mo.
McDougall Co., Ltd., R., Galt, Ont.
Ministry of Munitions, London, Eng.
Mueller Machine & Tool Co., Cincinnati, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Porter-Cable Machine Co., Syracuse, N.Y.
Rockford Lathe & Drill Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Ryerson & Son, Jos. T., Chicago, Ill.
Sidney Machine Tool Co., Sidney, Ohio.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Blaahill Wire Machy. Co., Ltd., Montreal.
Sidney Machine Tool Co., Sidney, Ohio.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Acme Machine Tool Co., Cincinnati, Ohio.
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont.

Lathes, Relieving
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Lathes, Spinning
Terry & Co., John C., Birmingham, Eng.

Lathes, Threading
Canada Machinery Corp., Galt, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Lighting Fixtures
Northern Electric Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Can. Foamite Firefoam Co., Hamilton, Ont.
Dennis Wire & Iron Works, London, Ont.

Lubricants
Cateract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser & Co., Inc., S. F., Fort Wayne, I.

Machinists' Small Tools
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Dodge Mfg. Co. of Can., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Goodell & Pratt Co., Greenfield, Mass.
Jones & Shipman, of Leicester, England, Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Ministry of Munitions, London, Eng.
National Machine Tool Co., Racine, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundaa, Ont.
Rapid Tool & Machine Co., Lachine, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Ryerson & Son, Jos. T., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wheel Trueing Tool Co., Detroit, Mich.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Atkins & Co., Inc., E. C., Indianapolis, I.
Cleveland Twist Drill Co., Cleveland, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Deloro Smelting & Refining Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hoyt Metal Co., Toronto, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Magnolia Metal Co., Montreal, Que.
Ministry of Munitions, London, Eng.
Moore & Son, Thos., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Metalite Cloth
Ritchey Supply Co., Toronto, Ont.

Meters, Steam Flow
Republic Flow Meters Co., Toronto, Ont.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackwortbie, Ltd., John, Birmingham, Eng.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smitb Machine Co., Hamiltou, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmitb Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundaa, Ont.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Die
Thurston Mfg. Co., Providence, R. I.

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
McCroskey Tool Corp., Meadville, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Lucas Machine Tool Co., Cleveland, Ohio.
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Lucas Machine Tool Co., Cleveland, Ohio.
McCroskey Tool Corp., Meadville, Pa.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
Toomey Inc., Frank, Philadelphia, Pa.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Lucas Machine Tool Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Ryerson & Son, Jos. T., Chicago, Ill.
Thurston Mfg. Co., Providence, R. I.
Toomey Inc., Frank, Philadelphia, Pa.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Lucas Machine Tool Co., Cleveland, Ohio.
Rockford Milling Machine Co., Rockford, Ill.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I.
Garlock-Walker Mchy. Co., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nickel Plating Outfits
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Nickel Silver
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.

Nitrogen
L'Air Liquide Society, Toronto, Ont.

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.

Oil Filtering and Storage Systems
Bowser & Co., Inc., S. F., Fort Wayne, I.

Oil Storage Engineers
Bowser & Co., Inc., S. F., Fort Wayne, I.

Oils
Canadian Oil Companies, Ltd., Toronto, Ont.
Cateract Refining Co., Toronto, Ont.
Imperial Oil Ltd., Toronto, Ont.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont.

Oils, Soluble
Cateract Refining Co., Toronto, Ont.
Imperial Oil Ltd., Toronto, Ont.

Oil Stones
Carborundum Co., Niagara Falls, N.Y.

Oxygen
Carter Welding Co., Toronto, Ont.
Dominion Oxygen Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.

Oxy-Acetylene Apparatus
L'Air Liquide Society, Toronto, Ont.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Durabla Manufacturing Co., New York.
Graton & Knight Mfg. Co., Worcester, Mass.
Greene, Tweed & Co., New York City.
Guildford & Sons, Ltd., Halifax, N.S.
Gutta Percha & Rubber, Toronto, Ont.
International Machinery & Supply Co., Montreal, Que.

Packing, Rod and Steam
Durabla Manufacturing Co., New York.
Quaker City Rubber Co., Philadelphia, Pa.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Durabla Manufacturing Co., New York.
Graton & Knight Mfg. Co., Worcester, Mass.
Greene, Tweed & Co., New York City.
Guildford & Sons, Ltd., Halifax, N.S.
Gutta Percha & Rubber, Toronto, Ont.
International Machinery & Supply Co., Montreal, Que.

Paper (Safepack)
Transportation Service Ltd., Toronto, Ont.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.
Marion & Marion, Montreal, Que.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Canada Machinery Corp., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Penstocks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.

Photographic Duplicating Machines
Comuercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto, Ont.

BUYERS' DIRECTORY

Pipe Cutting and Threading Machines
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National A me Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planers, Parallels
L. & P. Mfg. Co., Niagara Falls, Ont.

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Cowan & Company, of Galt, Ltd., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
L. & P. Mfg. Co., Niagara Falls, Ont.
Morton Mfg. Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich.
Toomey Inc., Frank, Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto, Ont.

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Pneumatic Tools
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
International Macbinery & Supply Co., Montreal, Que.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Polishing and Buffing Machines
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.

Pressed Steel Parts
Ackworthie, Ltd., John, Birmingham, Eng.
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Lucas Machine Tool Co., Cleveland, Ohio.
National Engineering Co., Sarnia, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Presses, Banding

Presses, Broaching

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Terry & Co., John C., Birmingham, Eng.

Presses, Forcing
Atlas Press Co., Kalamazoo, Mich.
Lucas Machine Tool Co., Cleveland, Ohio.
Niagara Machine & Tool Works, Buffalo, N.Y.
Stewart & Co., Duncan, Glasgow, Scot.

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Laurie Mfg. Co., Springfield, Ill.
Niagara Machine & Tool Works, Buffalo, N.Y.
Perrin Ltd., W. R., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Lucas Machine Tool Co., Cleveland, Ohio.
Niagara Machine & Tool Works, Buffalo, N.Y.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Positive Clutch & Pulley Works, Toronto, Ont.

Pulleys, Metal
American Pulley Co., Philadelphia, Pa.
Bernard Industrial Co., A., Fortierville, Que.
Can. Fairbanks-Morse Ltd., Montreal. Q
Canadian SKF Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Pulp and Paper Mill Equipment
MacKinnon Steel Co., Sherbrooke, Que.

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill.

Pumps, Circulating and Coalant
Trahern Pump Co., Rockford, Ill.

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill.

Pumps, Industrial
Trahern Pump Co., Rockford, Ill.

Pumps, Hydraulic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Electric Steel & Engineering Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot.
Trahern Pump Co., Rockford, Ill.

Pumps, Lubricant and Oil
Bowser & Co., Inc., S. F., Fort Wayne, I.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser & Co., Inc., S. F., Fort Wayne, I.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Electric Steel & Engineering Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.
Whitney Mfg. Co., W. A., Rockford, Ill.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Ryerson & Son, Jos. T., Chicago, Ill.
Toledo Machine & Tool Co., Toledo, Ohio.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
General Combustion Co. of Can., Ltd., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que.

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Victor Tool Co., Waynesboro, Pa.

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
McCroskey Tool Corp., Meadville, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
International Macbinery & Supply Co., Montreal, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Clevelaud, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisbolt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Macbine & Tool Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Taylor Tool Co., J. A. M., Toronto, Ont
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madisou, Wis.
International Business Machines Co., Toronto, Ont.

Regulators, Automatic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Respirators
Willson Goggles, Inc., Reading, Pa.

Rivets
Parmenter & Bulloch Co., Gananoque, Ont.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.
Ryerson & Son, Jos. T., Chicago, Ill.

Riveting Machines
Bliton Machine Co., Bridgeport, Conn.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Ryerson & Son, Jos. T., Chicago, Ill.
Schuster Co., F. B., New Haven, Conn.

Rolling Mill Equipment
Stewart & Co., Duncan, Glasgow, Scot.

Rolls (Rubber Covered)
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa.

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Paper
Wausau Abrasives Co., Chicago, Ill.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co., Chicago, Ill.

Sand Rammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Clemson Bros., Inc., Hamilton, Ont.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Ryerson & Son, Jos. T., Chicago, Ill.

Sawing Machines, Power Hack
Ackworthie, Ltd., John, Birmingham, Eng.
Atkins & Co., Inc., E. C., Indianapolis, I.
Levis, The, Toronto, Canada.
Perfect Machine Co., Ltd., Galt, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Cowan & Company, of Galt, Ltd., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
McKenzie Machinery Co., Guelph, Ont.
Oliver Macbinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Cowan & Company, of Galt, Ltd., Galt, Ont.
Simonds Canada Saw Co., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Saws, High Speed Steel
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.
Cowan & Company, of Galt, Ltd., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont,

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Inc., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal, Q.

Screens
Can. Wire & Iron Goods Co., Hamilton, Ont.

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Screw Extractors
Cleveland Twist Drill Co., Cleveland, O.

Screw Machine Work
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Cleveland, Ohio.
Tallman Brass & Metal Co., Hamilton, Ont.

BUYERS' DIRECTORY

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Acme Machine Tool Co., Cincinnati, Ohio.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Screws, Machine
Barnes Co., Wallace, Bristol, Conn.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Seamless Tubing. (See Tubing, Seamless Steel
Ontario Metal Products Co., Ltd., Toronto, Ont.

Second-Hand Machinery
(See Searchlight Section)
Petrie, Ltd., H. W., Toronto, Ont.

Separators, Moisture and Oil
Bowser & Co., Inc., S. F., Fort Wayne, I.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Separators, Oil and Waste
Bowser & Co., Inc., S. F., Fort Wayne, I.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Wilkinson & Kompass, Hamiltoo, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Canada Machinery Corp., Galt, Ont.
Cowan & Company, of Galt, Ltd., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Holly, R. S., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
McKenzie Machinery Co., Guelph, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Smith & Mills Co., Cincinnati, Ohio
Toomey Inc., Frank, Philadelphia, Pa.
Walcott Lathe Co., Jackson, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.
Whitney Mfg. Co., W. A., Rockford, Ill.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Stewart & Co., Duncan, Glasgow, Scot.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Doniolon Sheet Metal Corporation, Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., John C., Birmingham, Eng.
Toledo Machine & Tool Co., Toledo, Ohio.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Moore H. A. Co., Rochester, N.Y.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Moore H. A. Co., Rochester, N.Y.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Spectacles, Industrial
Willson Goggles, Inc., Reading, Pa.

Springs
Barnes Co., Wallace, Bristol, Conn.
Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Dyrab Steel (Consolidated) Ltd., Toronto, Ont.
Steele Ltd., James, Guelph, Ont.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Barnes Co., Wallace, Bristol, Conn.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Elliott & Whitehall Tool Co., Galt, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Stairways, Wrought Iron
Can. Wire & Iron Goods Co., Hamilton, Ont.

Steam Specialties
Crane Ltd., Montreal, Que.
Republic Flow Meters Co., Toronto, Ont.

Steel Plate
Hamilton Bridge Works Co., Ltd., Hamilton, Ont.
Dom. Foundries & Steel, Hamilton, Ont.

Steels, Tool
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Cold-Rolled Strip
Andrews Steel Co., Newport, Ky.
Barnes Co., Wallace, Bristol, Conn.
Can. Driver-Harris Co., Walkerville, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Steel Castings
Dom. Foundries & Steel, Hamilton, Ont.

Steel Hardness Measuring Instruments
Halcomb Steel Co., Syracuse, N.Y..

Steel, Shafting and Free Cutting Screw
Barnes Co., Wallace, Bristol, Conn.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Andrews Steel Co., Newport, Ky.
Firth & Sons, Ltd., Thos., Montreal, Q.
Illingsworth Steel Co., John, New York City, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Tanks
Can. John Wood Mfg. Co., Toronto, Ont.

Steel, Stainless
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Andrews Steel Co., Newport, Ky.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes Co., Wallace, Bristol, Conn.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Halcomb Steel Co., Syracuse, N.Y.
Illingsworth Steel Co., John, New York City, N.Y.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steels, High-Speed
Andrews Steel Co., Newport, Ky.
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Ltd., H. A., Montreal, Que.
Firth & Sons, Ltd., Thos., Montreal, Q.
Illingsworth Steel Co., John, New York City, N.Y.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Structural
MacKinnon Steel Co., Sherbrooke, Que.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stencil Machines
Diagraph Stencil Machine Corp'n, St. Louis, Mo.

Stencil Cutting Machines
Diagraph Stencil Machine Corp'n, St. Louis, Mo.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Stools, Shop
Ministry of Munitions, London, Eng.

Straightening Machinery
Bertrams Ltd., Edinburgh, Scotland.
Ryerson & Son, Jos. T., Chicago, Ill.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks, Steel
MacKinnon Steel Co., Sherbrooke, Que.
Can. John Wood Mfg. Co., Ltd., Toronto, Ont.

Tanks and Pumps, Oil
Bowser & Co., Inc., S. F., Fort Wayne, I.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Chesterman & Co., Ltd., J., Sheffield, Eng.
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
St. Louis Machine Co., St. Louis, Mo.

Taps and Dies
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
International Machinery & Supply Co., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rickert Shafer Co., Erie, Pa.
Taylor Tool Co., J. A. M., Toronto, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Rickert Shafer Co., Erie, Pa.
Victor Tool Co., Waynesboro, Pa.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Testing Metals and Materials
Toronto Testing Laboratory, Toronto, Ont.

Thermometers
Bristol Co., Waterbury, Conn.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Thread Cutting Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont

Thread Lead Testing Machines
Jones & Lamson Machine Co., Springfield, Vt.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
Bilton Machine Co., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Markers, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Steels for all Purposes
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Tools, Small (See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Burgess & Marchand, Montreal, Que.
Chesterman & Co., Ltd., J., Sheffield, Eng.
Dyrab Steel (Consolidated) Ltd., Toronto, Ont.
Elliott & Whitehall Tool Co., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Jones & Shipman, of Leicester, England, Toronto, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Kimber & Hillier Mfg. Co., St. Catharines, Ont.
Ministry of Munitions, London, Eng.
National Machine Tool Co., Racine, Wis.
Rapid Tool & Machine Co., Lachine, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Starrett Co., L. S., Athol, Mass.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wheel Trueing Tool Co., Detroit, Mich.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.

Torches, Blow
Can. Hauck Burner Co., Port Hope, Ont.
International Machinery & Supply Co., Montreal, Que.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Positive Clutch & Pulley Works, Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Transportation Systems (See Trucks)
Mathews Gravity Carrier Co., Port Hope, Ont.

BUYERS' DIRECTORY

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Reading Chain & Block Co., Reading, Pa.
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can. Fairbanks-Morse Ltd., Montreal, Q.
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Trucks, Industrial Motor
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Turrets, Tool Post
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Unions, Pipe
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Welding Machines, Oxy-Acetylene
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Holden Co., Ltd., Montreal, Que.
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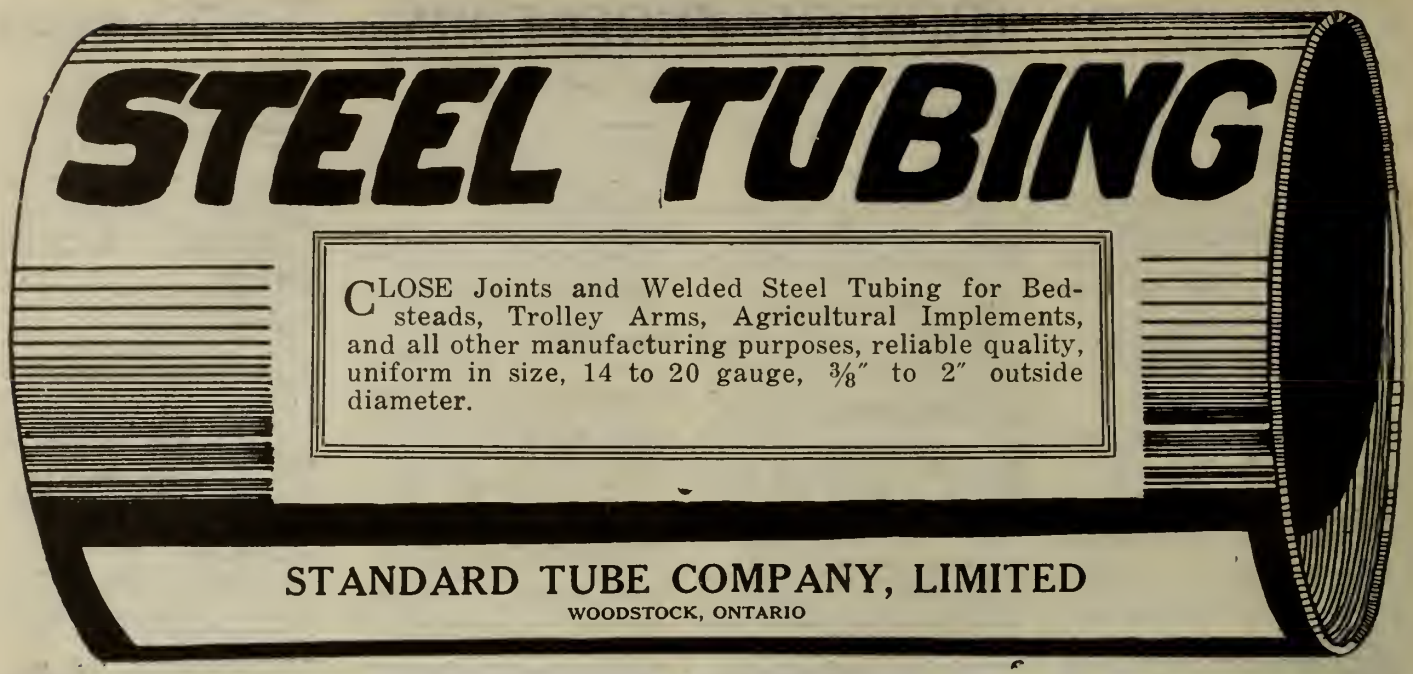
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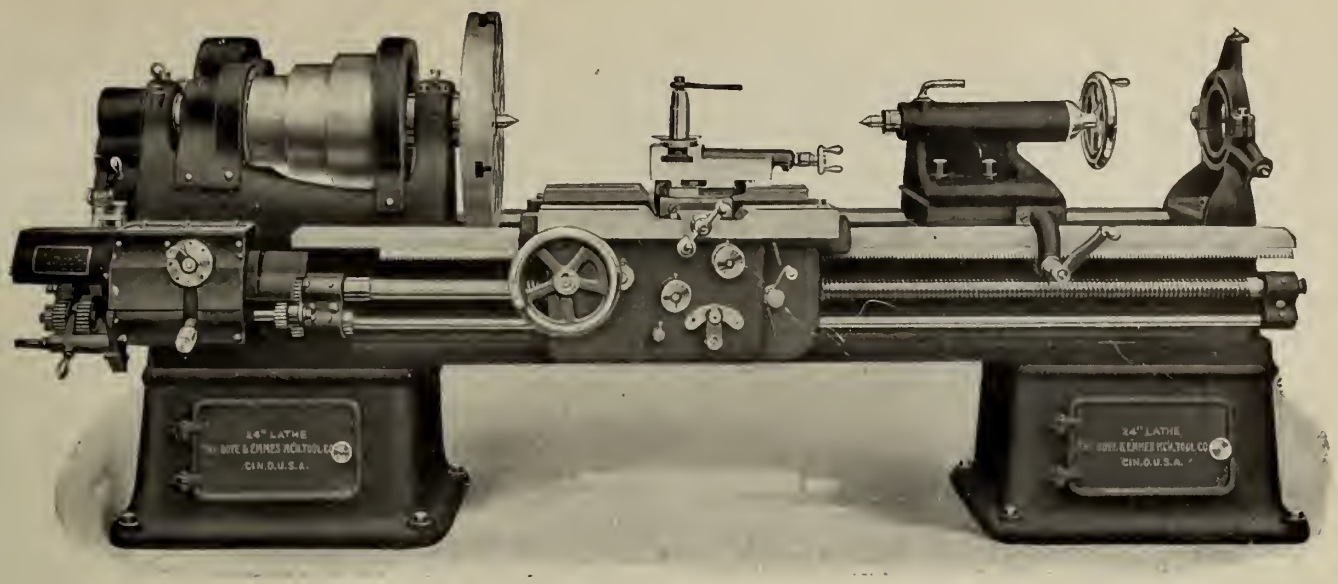
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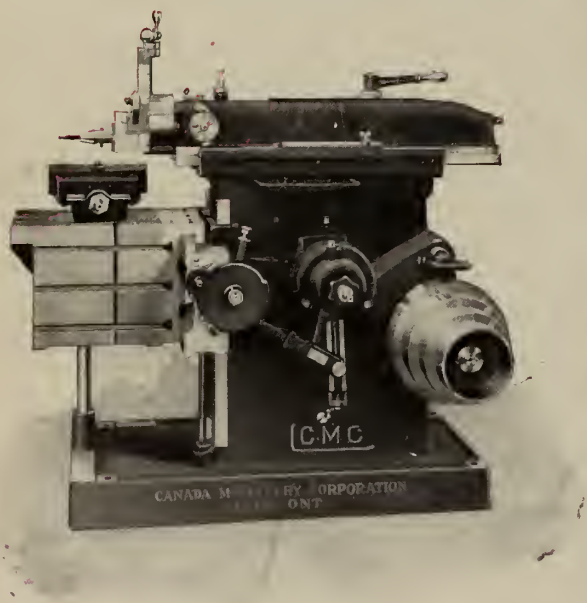
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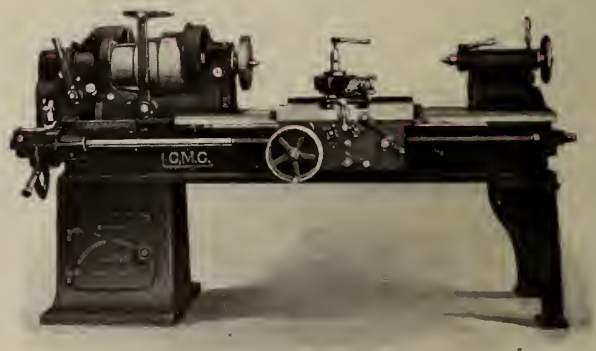
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